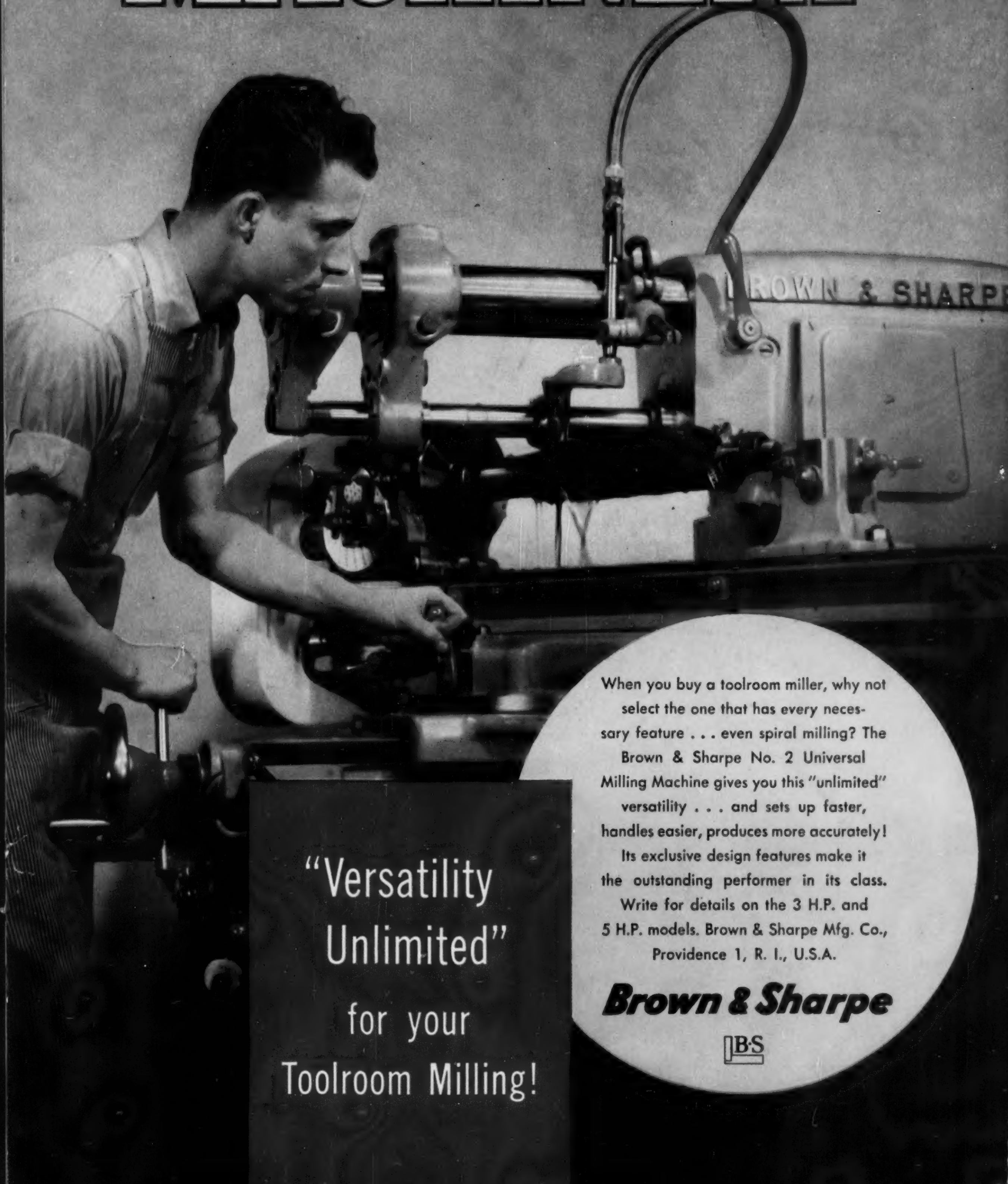
MAY 1955—SIXTY-FIRST YEAR

MACHINERY



MACHINERY
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Detroit 35, Mich.

DON HARWAY & COMPANY
1709 W. Eighth St., Los Angeles 17, Calif.

MACHINERY, published monthly by The Industrial Press, Emmett St., Bristol Conn. Executive offices, 93 Worth St., New York 13, N.Y.

Subscription Rates: United States and Canada one year, $4; two years, $7; three years, $8; foreign countries, one year, $7; two years, $13. Single copies 40 cents. Changes in address must be received by the fifteenth of the month to be effective for the next issue. Send old as well as new address.

Entered as second-class mail matter May 25, 1953, at the Post Office at Bristol, Conn., under the Act of March 3, 1879. Printed in the United States of America.

British Address
MACHINERY
National House, West St.
Brighton 1, England

French Address
LA MACHINE MODERNE
15, Rue Bleue
Paris-IXe, France

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MACHINERY

VOLUME 61 MAY, 1955 NUMBER 9

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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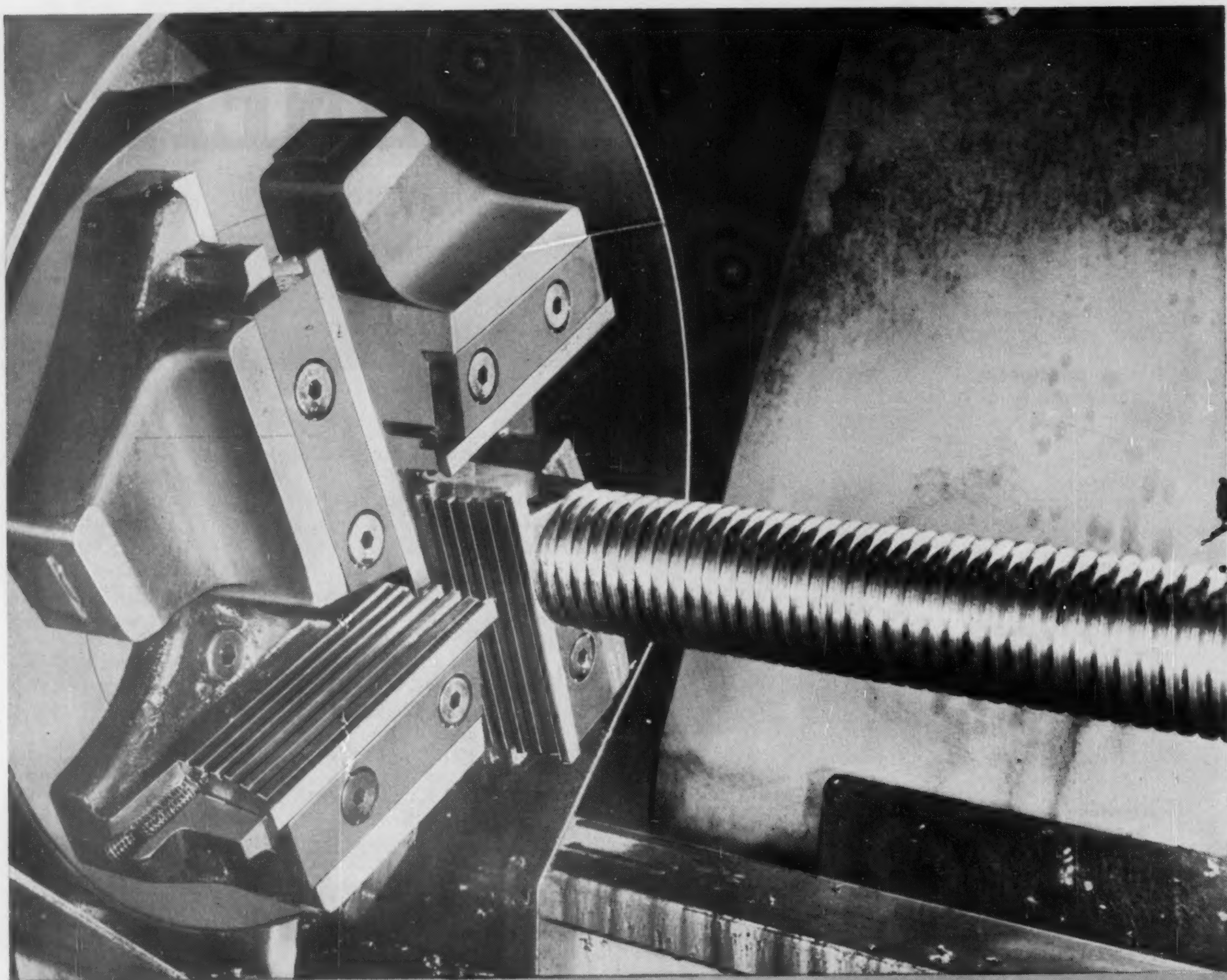
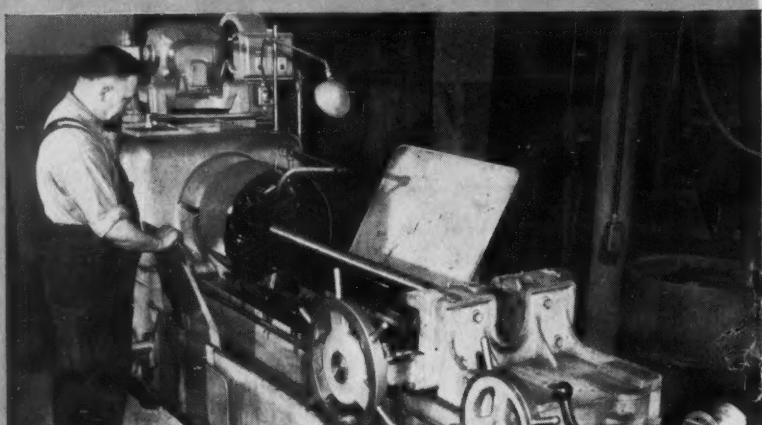
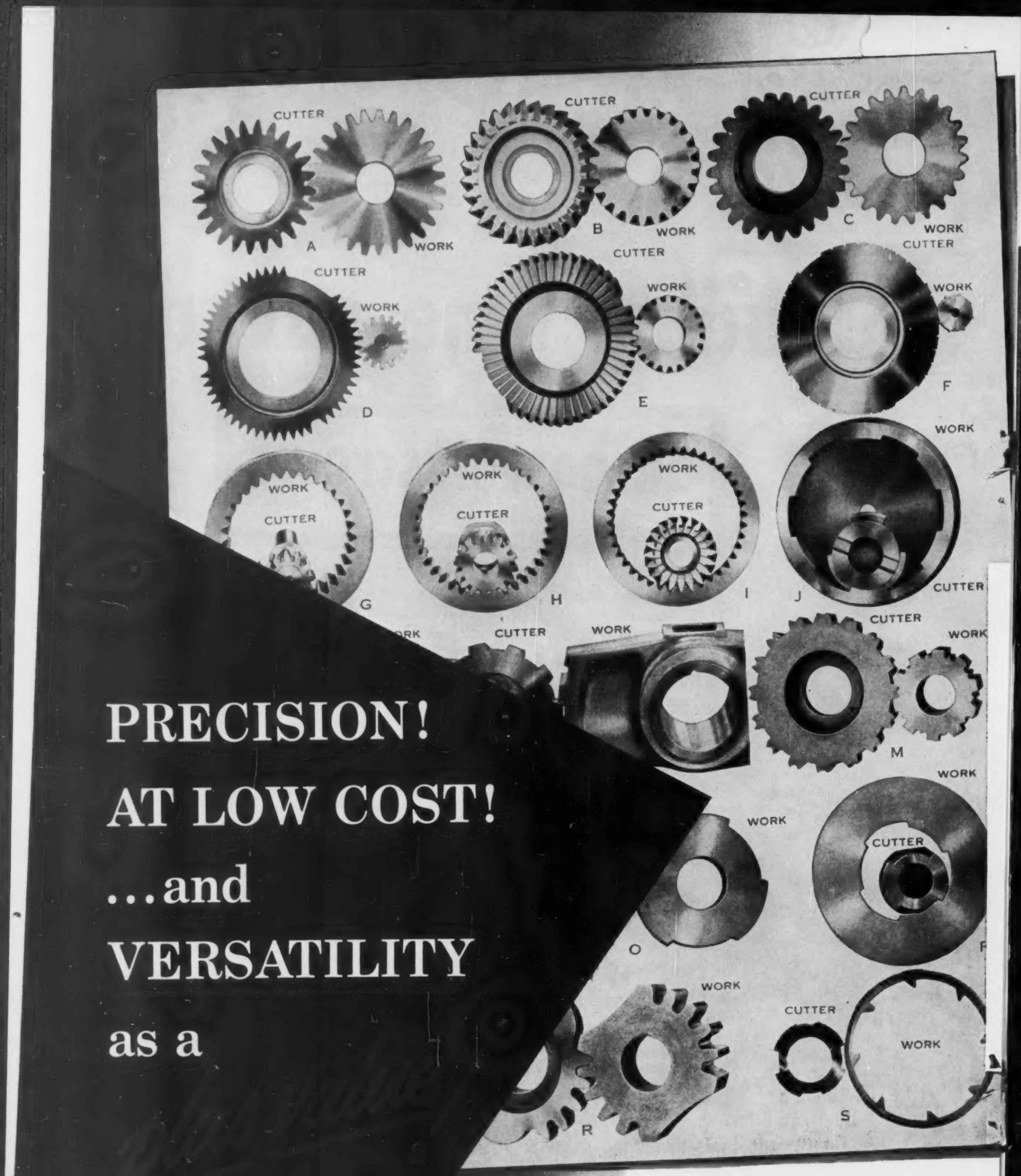
SOCIETY of BUSINESS MAGAZINE EDITORS



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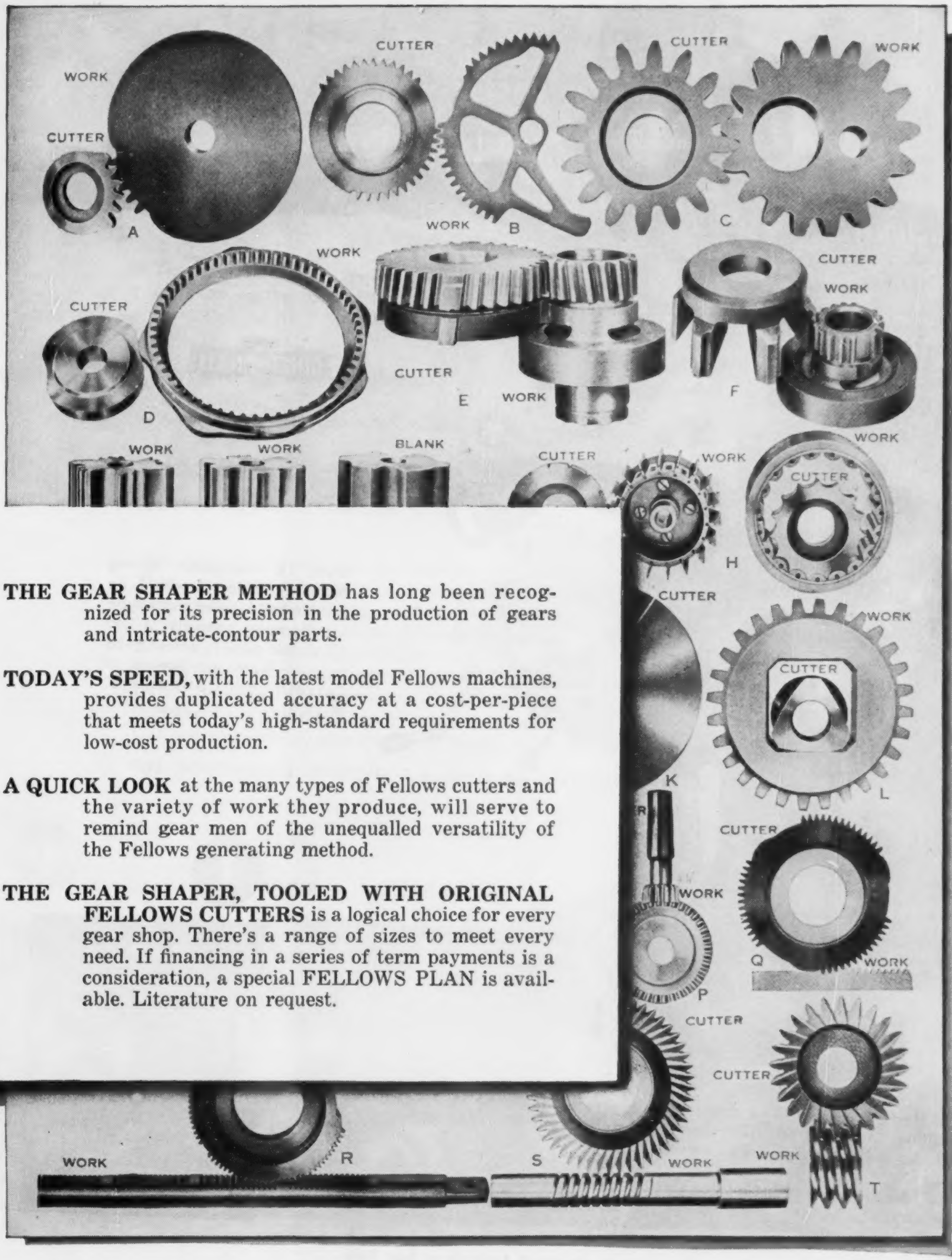
AT LOW COST!
...and
VERSATILITY
as a
THE Fellows



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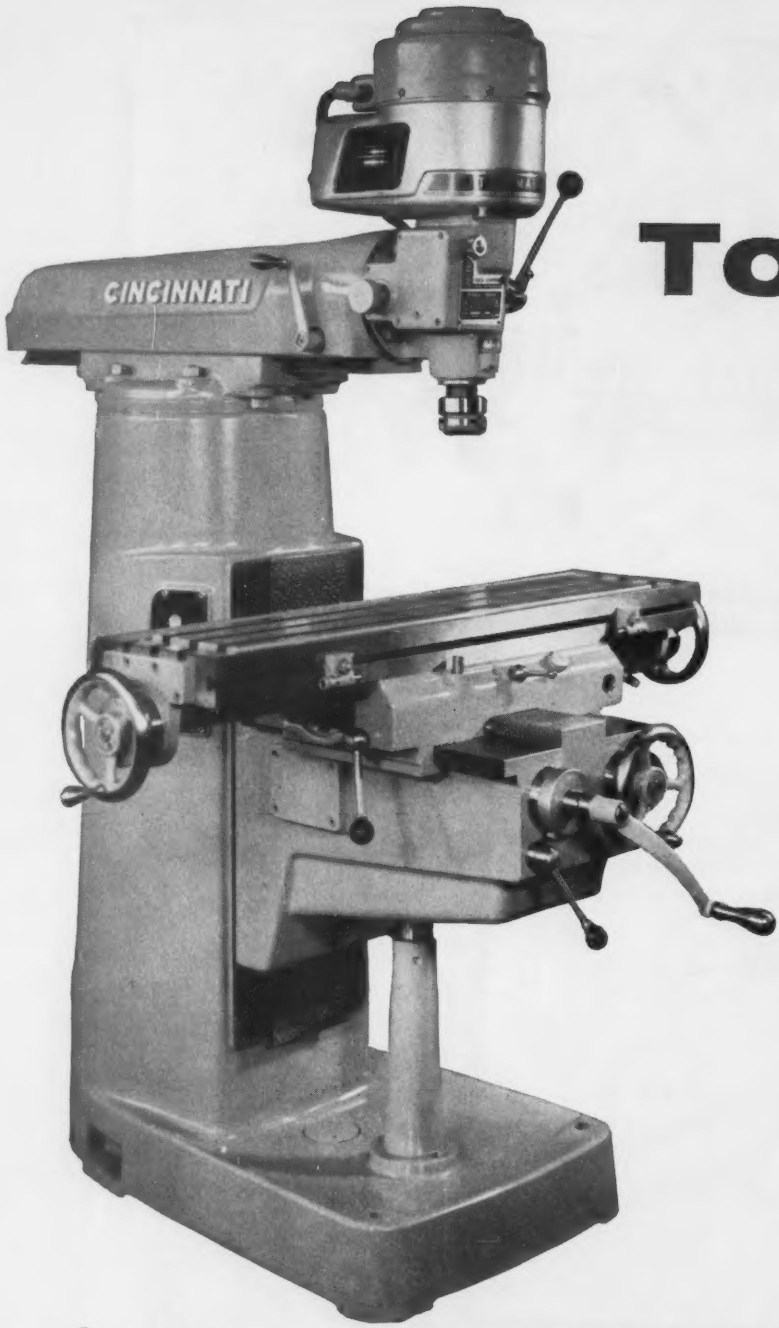

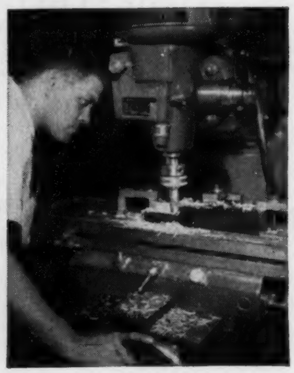

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Finish grinding two diameters of rear end pinion. Production increased by 50% with this heavy-duty Van Norman Production Grinder.

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Like all Van Norman Production Grinders this rugged, heavy-duty machine is precision engineered and built to assure maximum grinding accuracy at high production rates.

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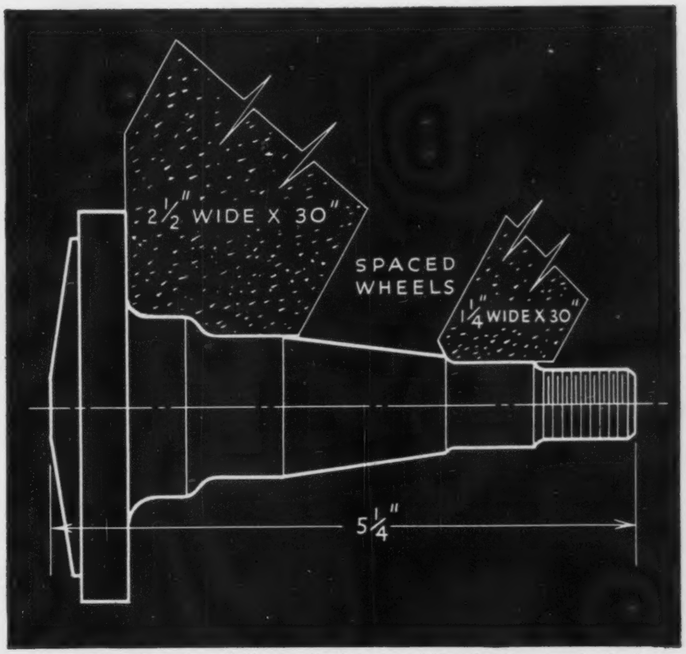
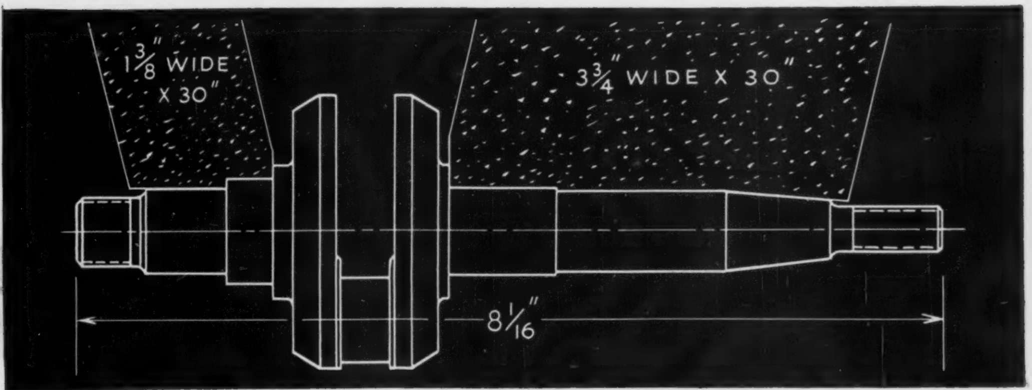


A single head angular grinding application on a pinion using two spaced wheels.



A double head angular grinding application on a crankshaft.

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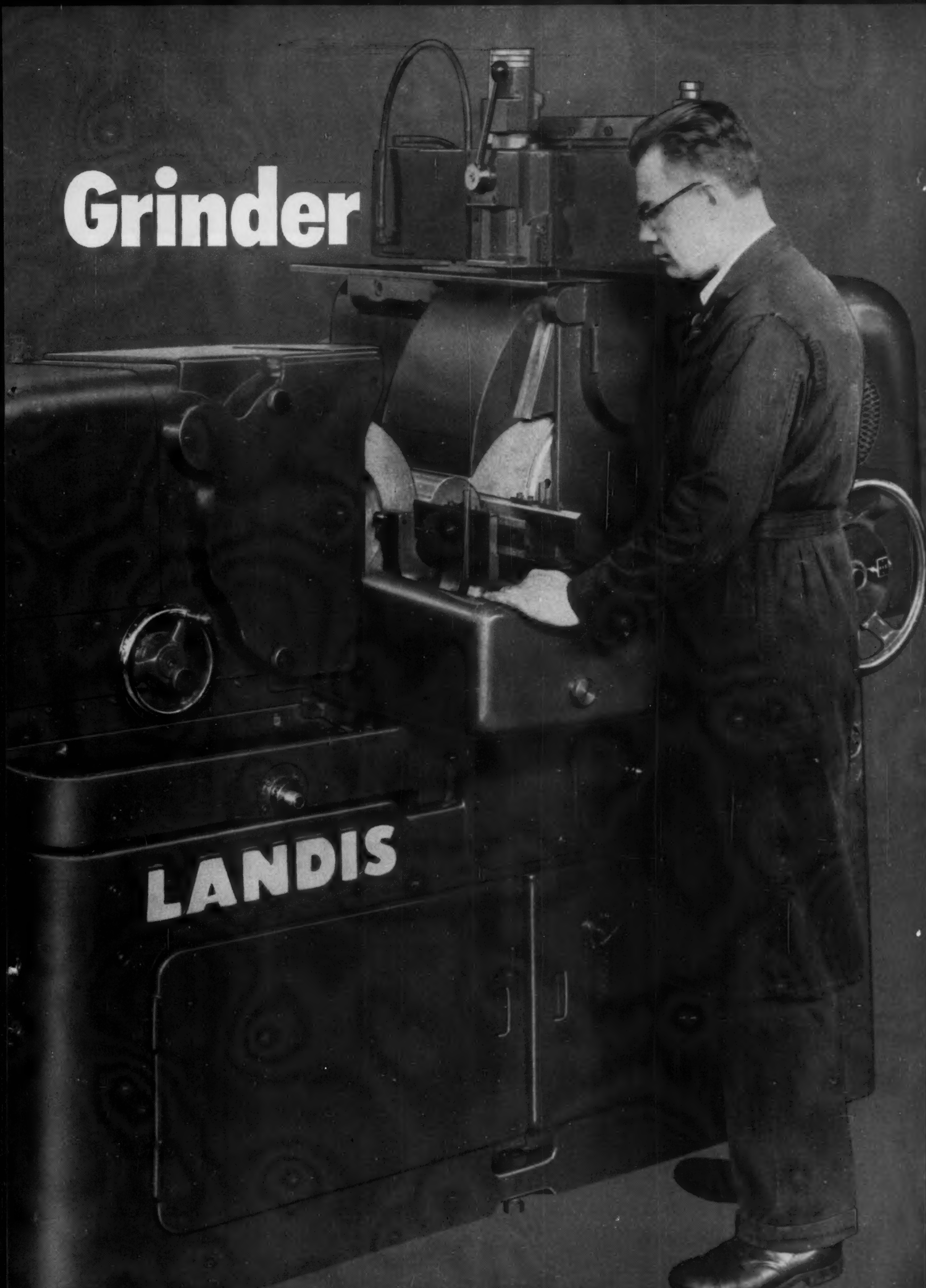
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For maximum press room efficiency . . .
For controlled unwinding of all types of stock in coils . . .

THE U. S. MULTI-ROLL

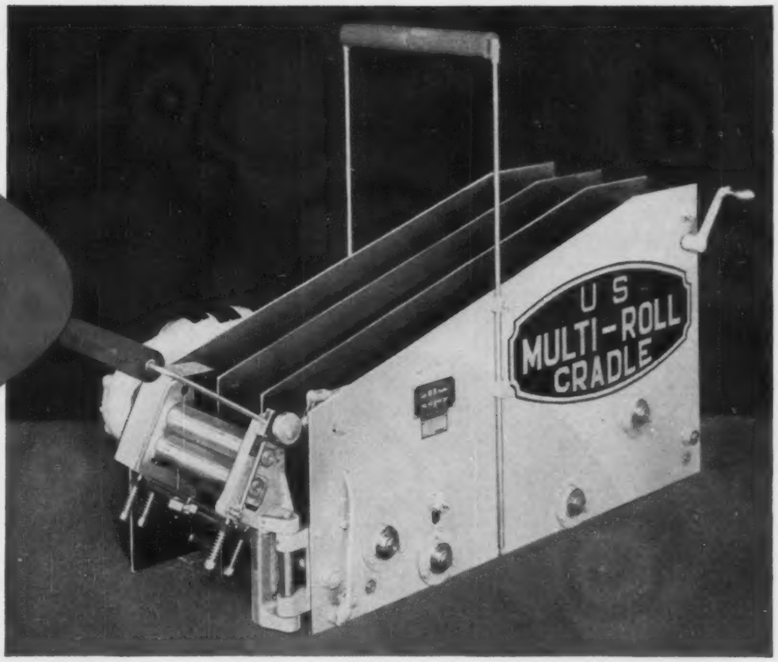
MAKES ANY PRESS AUTOMATIC!

Above: U. S. Multi-Roll Cradle Model ACC-1-9C, with four power-driven rest rolls plus a pair of power-driven take-out rolls. A geared motor of 1/3 H.P., 155 R.P.M. gives output speeds up to 80 feet per minute. For special applications other motors can be provided. The cradle will handle stock up to 1/8 inch in thickness, 9 inches in width, and coils with OD up to 40 inches. Photo shows Multi-Roll Cradle set up with a U. S. Stock Straightener and a U. S. Slide Feed to make the press completely automatic.

FAST, EASY LOADING!

Right: In the smaler sizes, coils of stock can be easily rolled into the cradle by one man. During the loading the take-out roll assembly is released by a trigger latch and swung to the side. It snaps securely into place when swung back

CRADLE



Right: U. S. Multi-Roll Cradle, Model ACC-1-9C, equipped with four power-driven rest rolls arranged in an arc to equalize weight distribution, plus a pair of power-driven take-out rolls. Also available as shown below right without take-out rolls.

With the U. S. Multi-Roll Cradle you get the fullest benefits from the advantages of using stock in coils. It has been designed to unwind stock in a steady, smooth run under complete control at all times. This is accomplished with four power-driven coil rest rolls mounted in self-aligning bearings and arranged in an arc to equalize weight distribution. In addition, on Model ACC-1-9C, further power is provided by a pair of power-driven take-out rolls to completely unwind coils which have a tendency to sag or slip when rest rolls only are used. Both sets of rolls are actuated by a loop control arm which operates through a micro switch. The stock can pass over the roller or press against it; either way, the feed to the press is positive and constant, and can be adjusted to rates up to 80 feet per minute. When handling some types of coils the power-driven take-out rolls may not be required, and the cradle can be purchased with the four power-driven coil rest rolls only (Model ACC-1-9NT.) On this unit the take-out rolls can be added later if needed.

The U. S. Multi-Roll Cradle is designed for easy and rapid coil loading, and the compactness of the frame and the controlled unwinding feature make it possible to set it up close to the press for most economical and safe use of floor space.

Get full details and specifications of the U. S. Multi-Roll Cradle in Special Bulletin No. 90-M. Write for your copy today.

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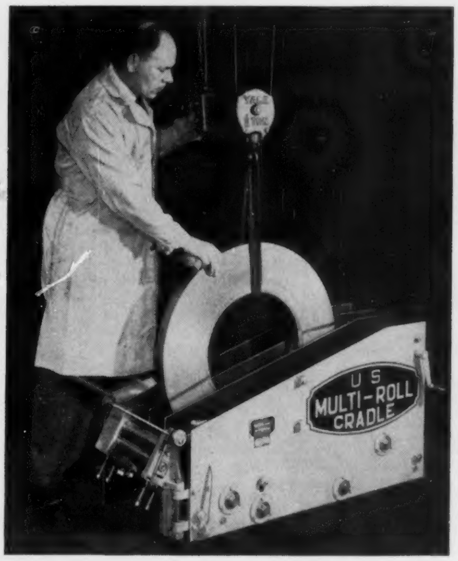
AMPERE (East Orange), NEW JERSEY

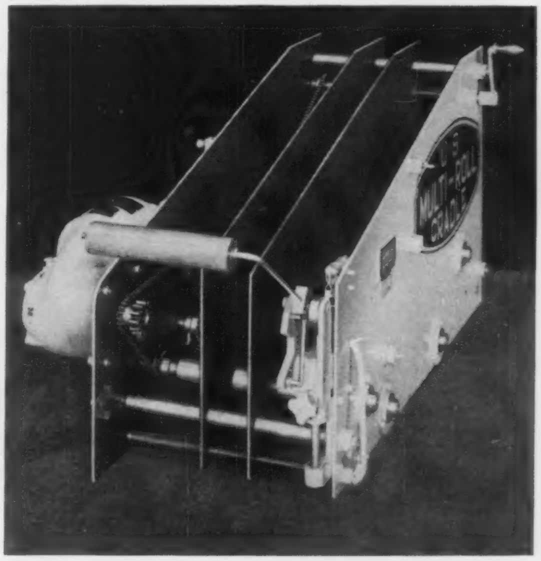
Builders of U. S. Multi-Slides—U. S. Multi-Millers—U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories



OVERHEAD LOADING!

Left: If the use of an overhead crane is preferred, it is easy to lower the coil between the two inner adjustable frames. Take-out roll assembly remains in operating position.

Right: Model ACC-1-9NT with four power-driven rest rolls only. This unit is designed so that power-driven take-out rolls can be added at any time.



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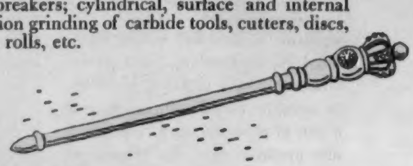
Carbide grinding's

Norton Vitrified Bonded Diamond Wheels feature fast stock removal and high resistance to grooving. Long service life is another big advantage, since this Norton-developed bond holds each diamond tightly, for maximum useful cutting action. *Typical Applications:* production grinding of single-point carbide tools; grinding chip breakers; cylindrical, surface and internal precision grinding of carbide tools, cutters, discs, gages, rolls, etc.



Norton Resinoid Bonded Diamond Wheels are made in two bond types — regular, for wet grinding and B6, for dry grinding. Each type gives you extra fast cutting action and long, money-saving wheel life. *Typical Applications:* grinding multi-tooth cutters, where their size-holding ability assures uniform height to each cutter tooth; cutting-off damaged carbide tools for salvage; grinding threads "from the solid" in carbide taps and thread gages.

"CROWN JEWELS"

Norton diamond wheels bring unbeatable economy to your production

You buy diamond wheels for carbide grinding as an investment in faster, better grinding performance and lower production costs.

You can be sure of peak profits from this investment when your choice is Norton diamond wheels. Backed by Norton's long leadership in development and manufacture — and by news-making "firsts" in diamond wheel progress — they're carbide grinding's recognized "Crown Jewels", with a royal reputation for the best in diamond wheel value!

"CROWN JEWEL" Highlights

NORTON: was first to introduce resinoid, metal and vitrified bonded diamond wheels . . . does all its own sizing, grading and laboratory checking of diamonds . . . duplicates wheel specifications with constantly controlled accuracy, to assure you uniform top performance . . . brings you a complete line, covering every diamond wheel application in every field — carbide, stone, glass, ceramics, etc. . . . gives you fast service from full stocks in Worcester, five warehouses and Distributor's stocks.

Your Norton Distributor

is ready with quick deliveries of the diamond wheels you need for better, more economical carbide grinding. Ask him for the 142-page illustrated booklet, *Grinding Carbide Tools,* and the complete net priced Diamond Wheel Catalog or write for them direct. And remember: only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower cost. NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

Making better products... to make your products better

Norton Metal Bonded Diamond Wheels are engineered by Norton for top savings on certain grinding jobs where great durability and resistance to grooving, rather than a fast rate of cut, are the chief requirements. *Typical Applications:* sharpening single-point carbide tools; reconditioning dull or chipped carbide tools; cutting-off sintered carbide blanks and a great variety of other materials — glass, porcelain, germanium, cermets and stone.

W-1614

NORTON

and its BEHR-MANNING division

NORTON: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

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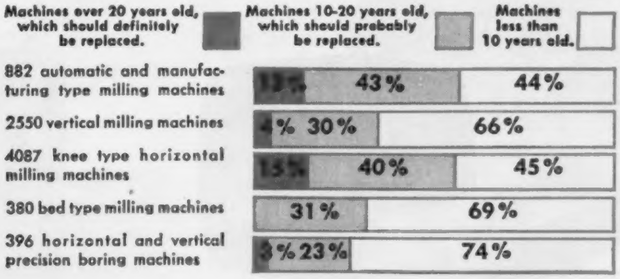
59 CENTS PER HOUR...

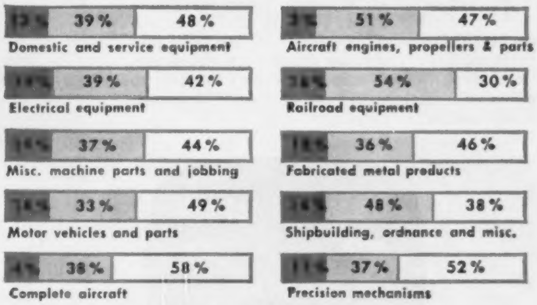
LET'S LOOK AT THE OBSOLESCENCE PICTURE IN THE INDUSTRY OF PRECISION MECHANISMS

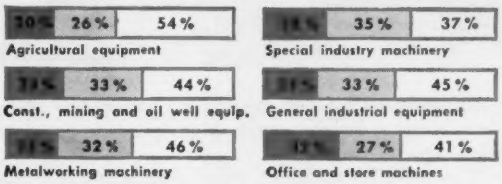
Includes machines for laboratory, scientific and engineering instruments; mechanical measuring, controlling instruments; optical; surgical; medical, dental instruments and equipment; photographic equipment; watches, clocks, clockwork devices, and parts. Of the total 8,295 machines, 10% are over 20 years old, over 36% are 10 to 20 years old.



HERE'S THE OVERALL PICTURE IN THE ABOVE AND 15 OTHER BASIC INDUSTRIES

Of the 150,825 machine tools in these industries of the types covered by Tool-Lease — 18% are over 20 years old and 38% are from 10-20 years old. A break-down on any of these industries will be furnished upon specific request.





Figures adapted from 1953 American Machinist survey of metalworking industry

THINK of it! You can lease this new Model C Autometric boring machine for as little as 59 cents per hour! It's an exceptionally low price to pay for this modern, high precision-built boring machine, designed specifically for performing the most exacting operations in your toolroom, laboratory or shop.

Under Plan "A," one of three possible lease agreements, you make two semi-annual payments, totaling 25% of the machine's price during each of the first three years. And only 10% during each of the last four years. What's more, this lease agreement permits you to terminate or purchase your Model C Autometric at the end of the third year or at the end of any year thereafter.

Under Kearney & Trecker's Tool-Lease program you can rent any of over 250 different types and sizes of standard milling machines or precision boring machines. All are available under three basic plans, with varying options to continue or terminate the lease, or to purchase the equipment. If you require special machinery or heavy-duty CSM bed types, special agreements will be considered.

For complete information on Tool-Lease, see your Kearney & Trecker representative or mail coupon to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

TOOL LEASE
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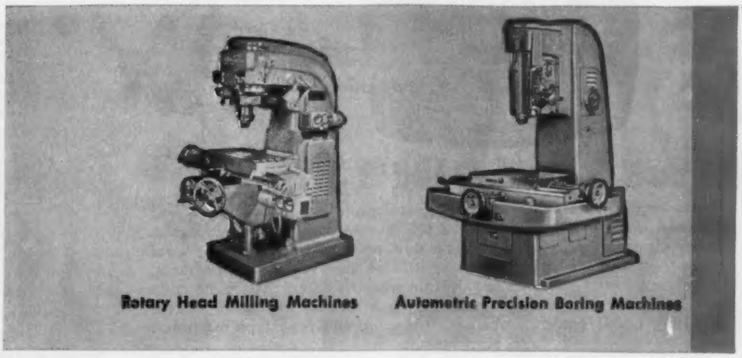
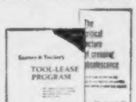
MILWAUKEE
MACHINE TOOLS
EQUIPMENT ®



Rotary Head Milling Machines   Autometric Precision Boring Machines

KEARNEY & TRECKER CORP.
6784 W. National Ave., Milwaukee 14, Wis.
Please send me Bulletin TL-10A on Tool-Lease Program and booklet titled "Critical Picture of Creeping Obsolescence."



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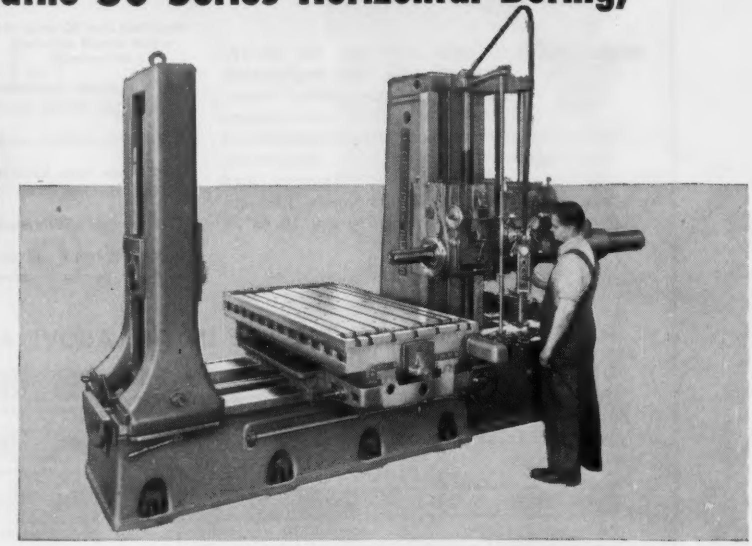
More optional arrangements give

with G & L versatile 30 Series Horizontal Boring,

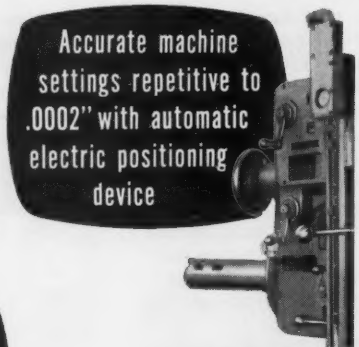
For accommodating large, heavy workpieces, various sizes of machine tables are available. Tables are rigidly supported on extended saddles (110" to 170") with saddle supports. This method of supporting the table provides extra rigidity . . . takes the guess work out of precision machining. What's more, it permits operator to move around the machine and the work without impeding his movements.



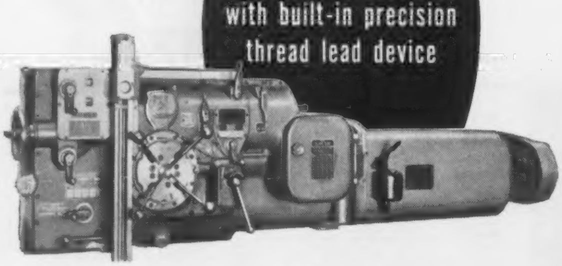
Model 340-T is equipped with 4-inch spindle and powered by 20 hp motor. Heavy-duty bearing design permits high speed range of 10 to 1300 rpm with 45 speed changes.

Bed Lengths — 72" to 120"; Table Sizes — from 36" to 60" widths up to 132" long with several intermediate sizes, and with 60" to 120" cross travel with saddle supports; Column Heights — 36" to 60". Also a full line of attachments and accessories are available for capacities over and above the usual run of the work.

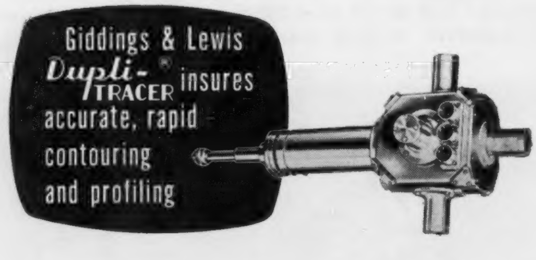
Giddings & Lewis' versatile built-in power rotary tables eliminate locating and resetting of unusual workpieces which consume the greater portion of floor-to-floor time. They're available with 1/2 degree graduation and 90 degree adjustable cam type index stops. Eighteen power feeds may be engaged. Table can be rotated for accurate indexing to .001" at any angle.



Electrically operated positioning device for both headstock and table travel is available on all G&L table machines with a 3, 4, or 5-inch diameter spindle. With it you eliminate time-consuming fine hand adjustments, work layout and inaccurate settings. It makes possible positive machine settings for precision boring operations repetitive to .0002", each mechanically controlled to pre-determined setting. It accurately selects, maintains and controls distances between machined holes.



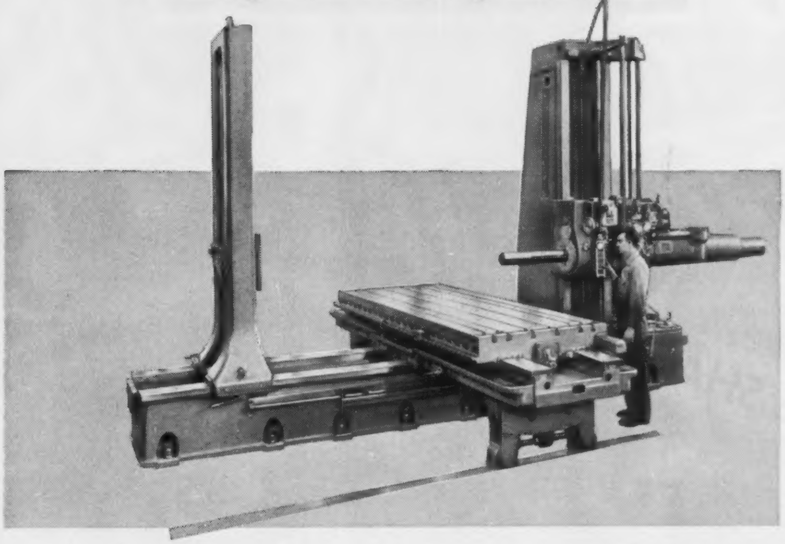
One of the important features of G&L machines is the built-in precision thread lead device. With it you can cut precision threads to any standard prescribed form, pitch and depth. A precision lead screw, attached to the ram, operates through pick-off gears which are available in various sizes.



Forms requiring intricate contouring and profiling, both internal and external, are machined rapidly and to close accuracy with Giddings & Lewis electronic Dupli-Tracer. The unit operates on a *selective dual system* — providing simultaneous control of the saddle and headstock, or saddle and table for contour milling work — or alternately the table and headstock may be automatically controlled to give 360 degree profiling. Dupli-Tracer is available for table and floor type machines.

you *More Profit Opportunities*

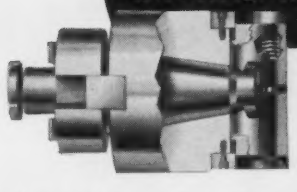
Drilling and Milling machines



Model 350-T is the same basic design as the 340-T except that it's a proportionately heavier machine. It's equipped with a 5-inch spindle and powered by a 25 hp, 1800 rpm motor. Bearing design permits high speed operation and a speed range of 7.5 to 975 rpm with 45 speed changes.

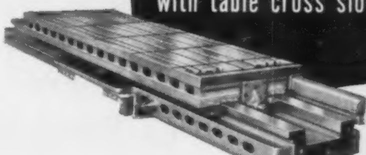
Bed Lengths — 96″ to 144″; Table Sizes — from 48″ to 60″ widths up to 132″ long with several intermediate sizes, and with 60″ to 120″ cross travel and saddle supports; Column Heights — 48″ to 72″. Additional equipment, attachments and accessories are also available to increase working capacity.

Quickly retain or eject cutting tool shanks with Quick Change spindle



New machine accuracy is always maintained with a G&L Quick Change spindle. You eliminate hammering to free shanks of cutting tools and prevent marring, distortion and expansion to spindle. It's optional at no extra cost instead of the Morse Taper spindle. When ordering specify Quick Change spindle.

Accurate locating of jigs and fixtures with table cross slots



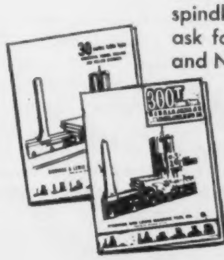
Precision table cross slots, machined at the factory, are recommended for greater rigidity and clamping of large workpieces. Cross slots assure positive alignment for locating jigs and various types of fixtures.

Giddings & Lewis Horizontal Boring, Drilling and Milling machines, table and floor types, give you a wider range of working capacities. They assure you greater profits than any other machine tools of their type and size. When you stop to consider the variety of operations possible, you'll understand why these machines are the most versatile and your best buy.

Models 340-T and 350-T, illustrated here, can be equipped with an extremely wide line of optional equipment and accessories, providing unlimited machining opportunities. For example, you can get power-driven rotary tables, extended saddles, precision thread lead unit, automatic electric positioning device, electronic Dupli-Tracer control head, Quick Change spindle, etc. With them, you're able to perform more machining operations and do them in less time . . . obtain better finishes . . . hold close tolerances and reduce setup time to a minimum.

Compare these G&L's, and you won't buy any other machine. For complete specifications, see our nearest representative, or write direct.

Write for Literature . . .
For complete specifications on Giddings & Lewis 3, 4 and 5″ spindle table type machines, ask for catalog No. 30-T and No. 300-T.



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Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Open Side Planers, Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

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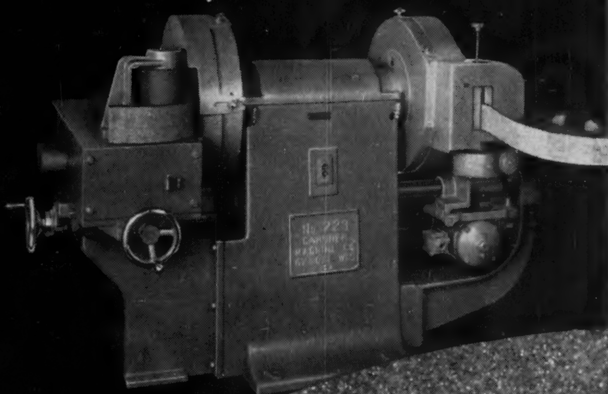
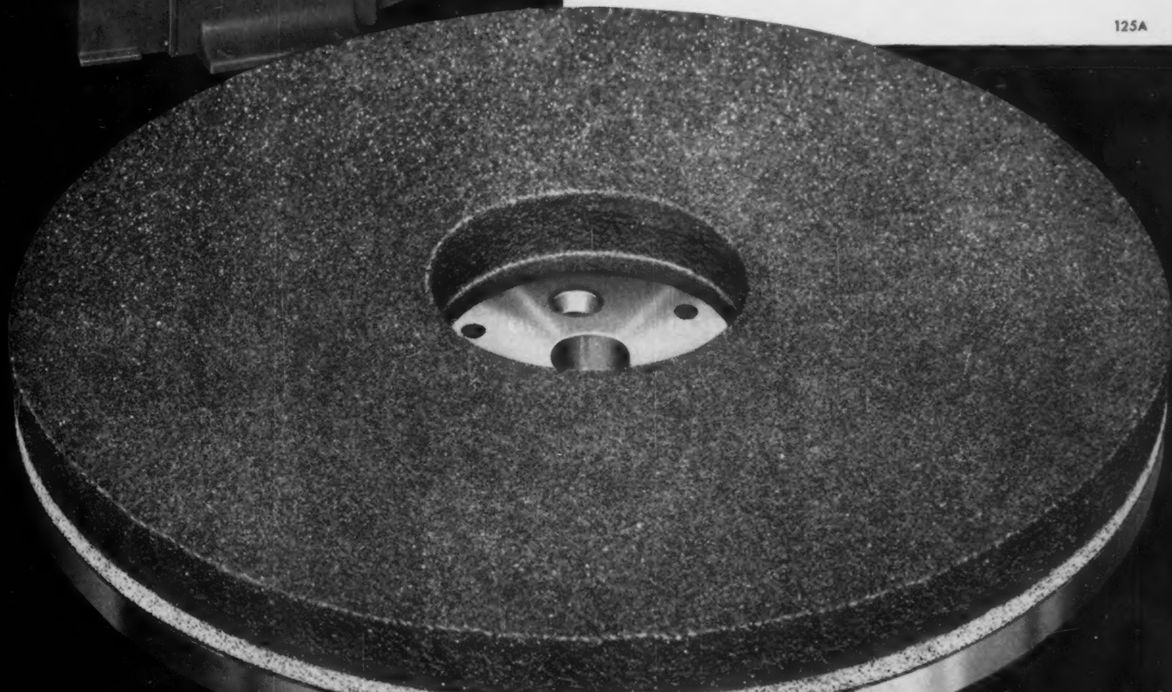
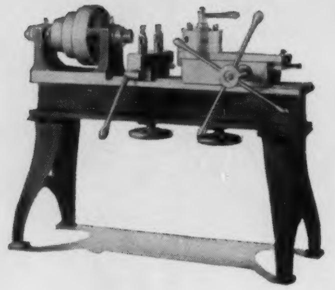




1880



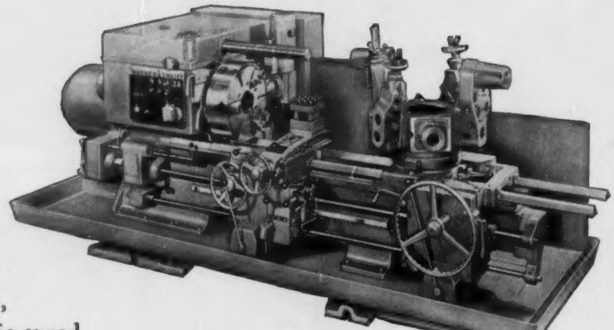
One of the first Warner & Swaseys . . .
but a machine designed to meet the high precision production requirements of its day.

Serving American Industry for

75 YEARS

...pacing the industry with ever improving designs in high precision machine tools to give you faster, more accurate, more profitable production.

1955



A machine designed for today's production schedules — *and tomorrow's!* It's one of a whole new line of extra-heavy duty Warner & Swasey Turret Lathes — engineered to provide new power, more usable cutting speeds, automatic speed changes and simplified controls, plus traditional Warner & Swasey accuracy and dependability!

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

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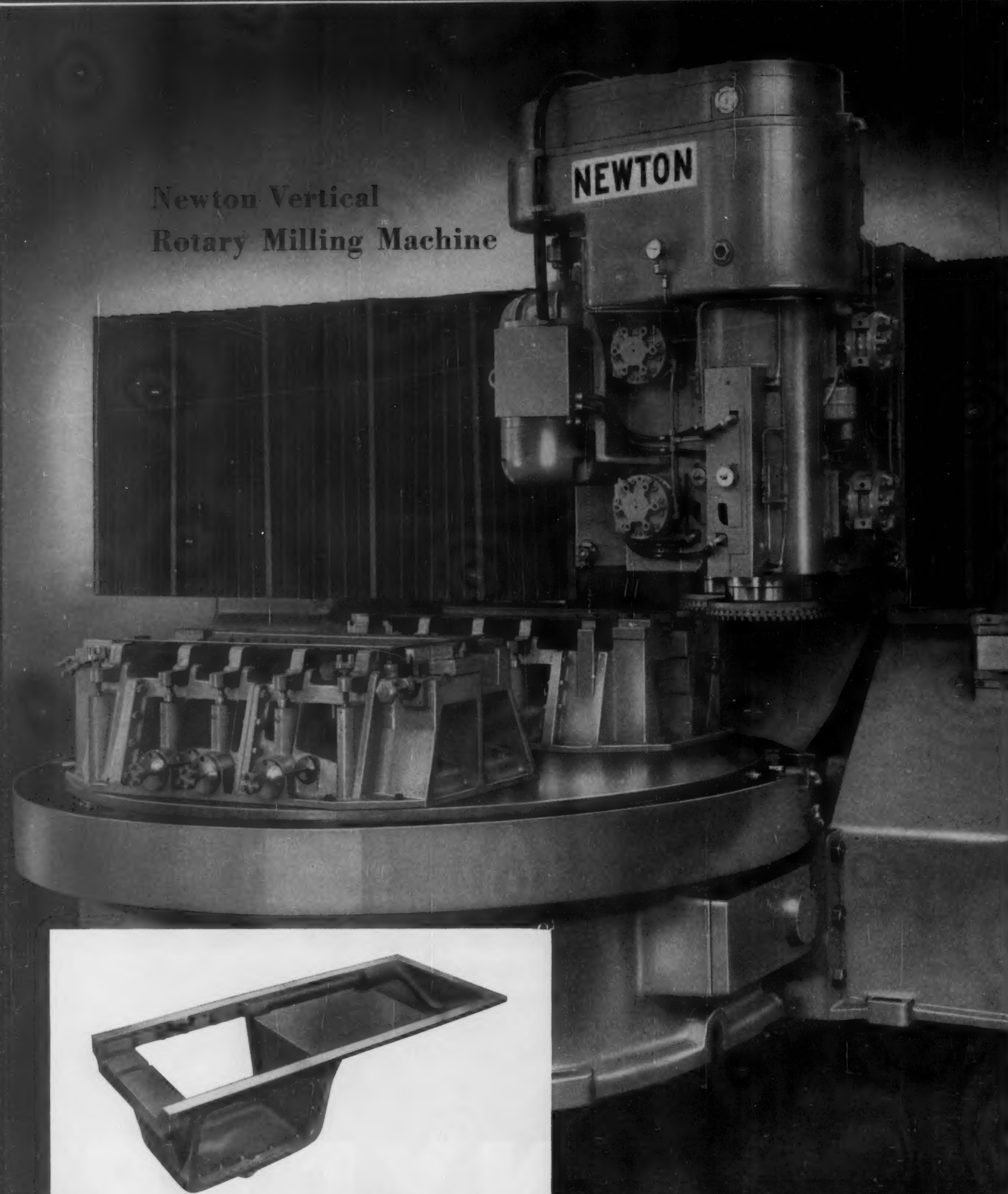
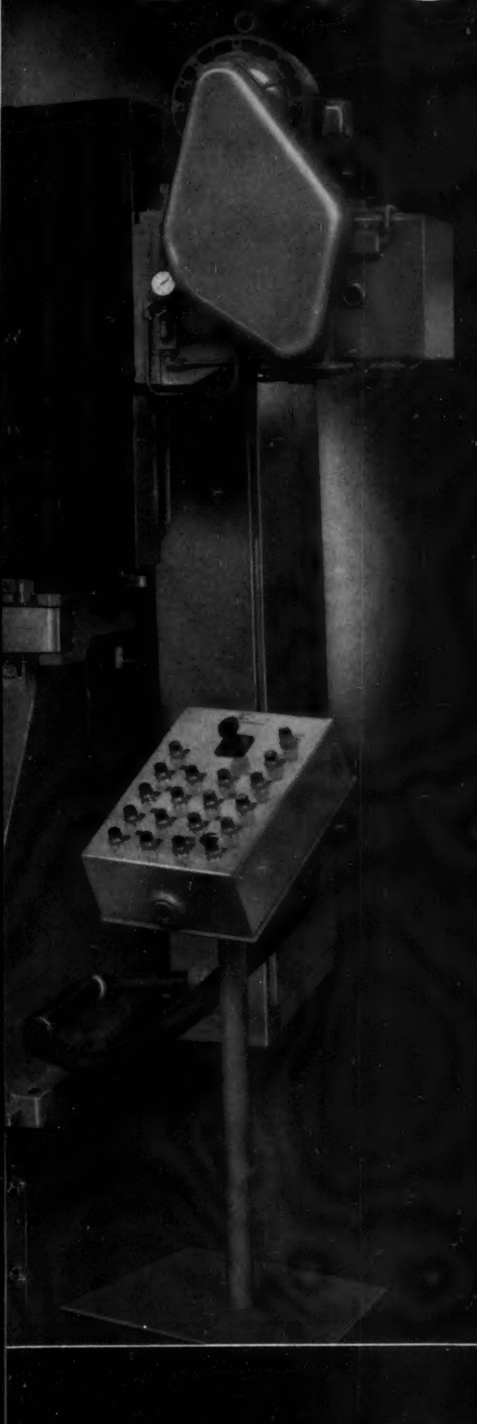

Newton Vertical
Rotary Milling Machine
NEWTON

TWO IN ONE



Here is a Newton Vertical Rotary set up for milling diesel engine oil pans. The head feeds along the cross-rail and mills the piece in one pass.

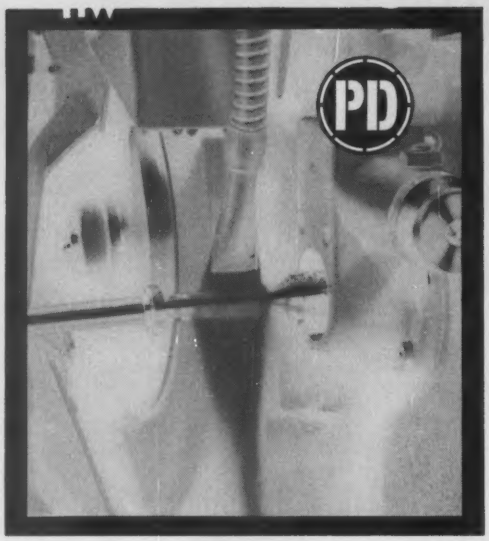
At the end of the cut, the spindles unclamp and retract. As the head returns to its starting point on the cross-rail, the table is automatically power indexed. The spindles lower and clamp and the next pan is milled.

This machine may run several weeks on oil pans. Then, by locking the head on the cross-rail and engaging the rotary table feed, it becomes a continuous rotary milling machine for an entirely different type of job! (Fixture change-over time—less than one hour.)

Two entirely different machines for not much more than the price of one. A good example of Consolidated's utility minded engineering.

COMPANY, ROCHESTER 10, N. Y.

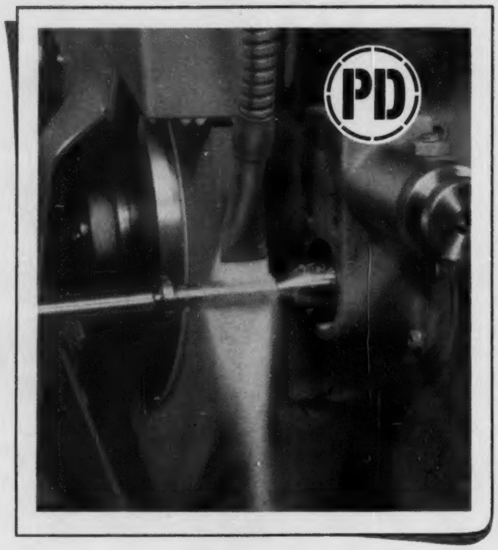
Birmingham Company, Incorporated



Save money and increase production through this remarkable development..

JUST AS A NEGATIVE guarantees you an exact duplication of a photograph each and every time, you are always assured a . . .

. . . POSITIVE DUPLICATION of an original grinding wheel each and every time through the CINCINNATI (PD) Manufacturing Process.



NOW!

Cincinnati Grinding Wheels offer

(PD) Positive Duplication

Here is the most talked about advancement in grinding wheels in years. And no wonder! Positive Duplication is an outstanding achievement in precision manufacturing and quality control that absolutely can *save you money* . . . and *increase your production.*

Through the CINCINNATI (PD) Manufacturing Process you are assured a Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

We'll be glad to prove to you how CINCINNATI (PD) WHEELS can save you money and increase your production. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

CINCINNATI *Grinding Wheels*

For more information on products advertised, use Inquiry Card, page 253

Q.

Why does Blanchard grind its own machine parts on a Blanchard?

A.

It's the only way we know to get highest quality at lowest cost!

Shown here are 117 different parts of a #18 Blanchard Grinder. 239 surfaces on these 117 parts were ground on a Blanchard, for the simple reason that *there isn't any better way.*

Everyone who uses Blanchard Grinders knows that Blanchard elements are machined with extreme accuracy . . . that they *have to be!*

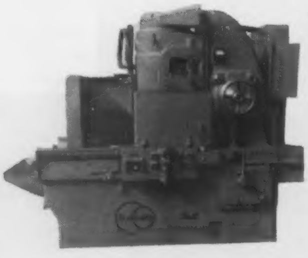
Furthermore, Blanchard users everywhere would undoubtedly agree fully with these two actual statements recently made by customers:

"There is no greater machine tool money value than a Blanchard. It is the best buy we ever made".

"Until our Blanchard went to work, I never realized I could actually save so much, as compared to previous methods of machining flat surfaces".

If you do not own a Blanchard, we invite you to select some of your own components, and let us give you estimates to compare with your present quality control tolerances and machining costs. Chances are you'll find it will pay you to ***"PUT IT ON THE BLANCHARD".***

P. S. You guarantee yourself full benefit from your Blanchard Grinders when you use the correct Blanchard abrasive wheels!



Send for free copies of "Work Done on the Blanchard", (fourth edition), and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY **64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.**

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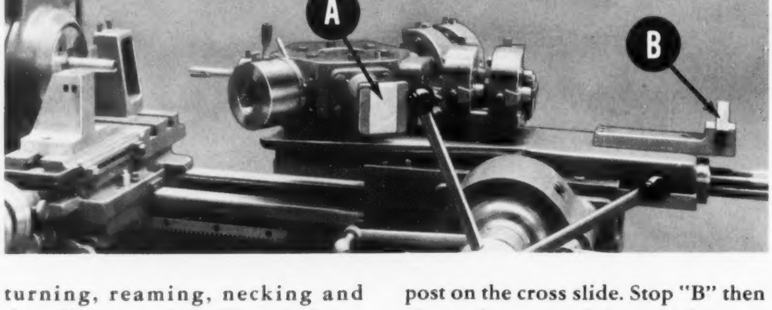
TIME-SAVING IDEAS

HOW TO DO LONG SHAFTS ON SHORT LATHE

Ram Type Machine Shows How Good Idea Can Save on Equipment Costs



The long and short of this pointer is worth remembering the next time you have a problem like it.

Here, a Gisholt No. 4 Ram Type Turret Lathe, which has 25¾ inches from hexagon turret face to spindle, is handling a 46⅝-inch-long shaft. The seamless steel tubing is fed through the spindle and locates against stock stop "A" for simple turning, reaming, necking and threading operations. Then the hexagon turret is indexed so that stop "A" again faces the work. The stop is hinged and flips up, permitting the bar stock to pass completely through the turret and locate against stop "B." The body of stop "A" acts as a steady-rest to prevent whip while the shaft is cut off to length from the rear tool post on the cross slide. Stop "B" then also swings out of the way for easy removal of the finished shaft. The whole job takes only 2.75 minutes floor-to-floor.

By simply allowing the workpiece to pass through the hexagon turret, a shaft nearly twice the length of the machine's capacity can be handled—sparing the need for a larger, more costly lathe.

TURRET-MOUNTED LOADER SPEEDS CHUCKING

Gisholt Fastermatic Automatic Turret Lathe uses Loading Arbor to Save Time and Effort.

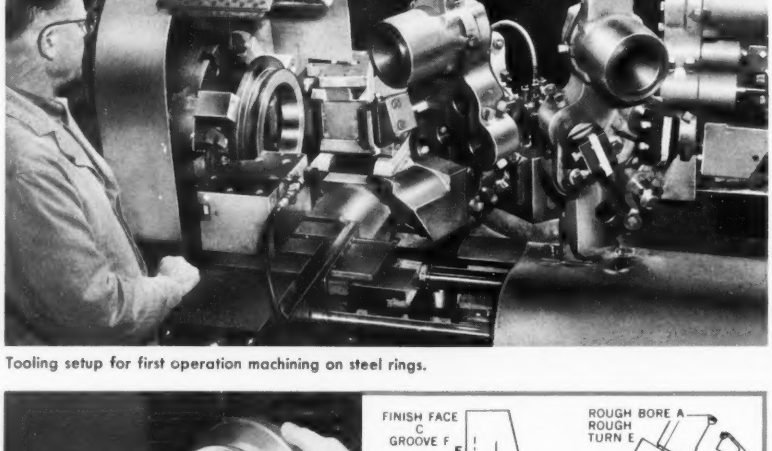
Even if you have your machining time down pat, you may still be able to cut over-all time further with a better loading method.

Here, to simplify and speed up chucking operations, this 2F Fastermatic has a special turret-mounted loader arrangement. As each machine cycle ends, the finished part is removed. Then forward movement of the hexagon turret carriage brings a rough workpiece on the loading arbor to the chuck. Spring-loaded studs on the arbor force the piece against the chuck jacks to locate the work.

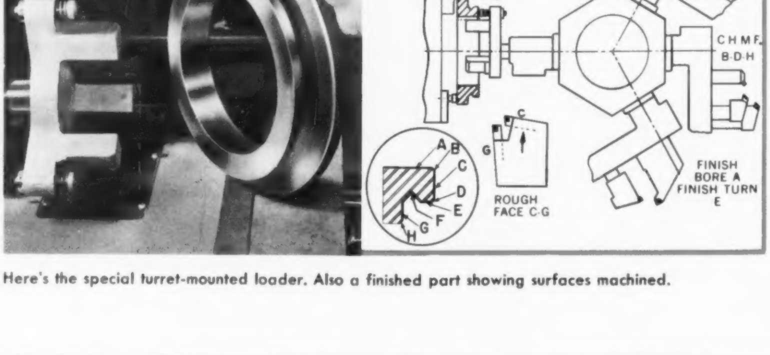
With simplified loading and chucking and a fully automatic machine cycle, time is just 6.9 minutes f.t.f.

The hexagon turret stations are tooled to turn, bore and chamfer with all facing and grooving operations on the steel rings performed from the front and rear cross slides.

Using a loading arbor on one turret face of the Fastermatic Automatic Turret Lathe reduces manual effort and simplifies chucking.



Tooling setup for first operation machining on steel rings.



Here's the special turret-mounted loader. Also a finished part showing surfaces machined.

TIME-SAVING IDEAS

AUTOMATIC LATHE DOUBLES AT SUPERFINISHING AND BEARINGIZING

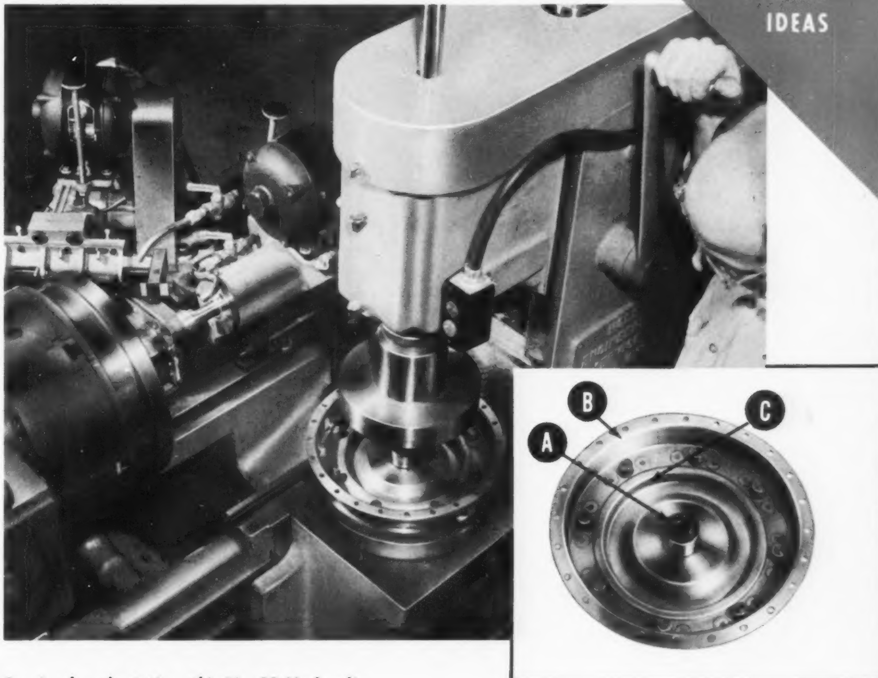
Gisholt No. 12 Hydraulic Lathe Adapts for Special Work

For many of those special jobs that come along present equipment can lend a hand. This unique application of a Gisholt No. 12 Hydraulic Lathe, where three jobs are performed in one handling, is a good case in point.

Here, it is specially tooled to finish automotive transmission converter clutch housing and bushing assemblies. Two No. 1 Superfinishing attachments are mounted on the rear independent slide. One Superfinishes the flat hub face (A) of clutch housing for thrust washer contact. At the same time the 45-degree sealing face (B) is also Superfinished.

While this part is being Superfinished, the preceding workpiece has its 8-inch bore (C) sized and finished by a vertical Bearingizer unit, also mounted on the No. 12 Hydraulic Lathe.

Production is fast—over 50 parts per hour. Tolerances are closely held and the required "controlled" surface finish readings easily obtained.



By simple adaptation, this No. 12 Hydraulic Automatic Lathe performs as a special machine to produce Superfinished and Bearingized parts.

To show tooling, Superfinishing quills are withdrawn, Bearingizer unit is raised. While part is Superfinished, another is Bearingized.

THREAD-GRINDING WHEELS BALANCED FOR MORE PRECISE WORK

Gisholt DYNETRIC Balancer Measures, Locates Unbalance to Eliminate Harmful Vibration

Thread-grinding wheels operate at high speeds and therefore must be very accurately balanced to eliminate vibration which would hamper grinding to close tolerances. For this type of workpiece, where the length along the axis is small compared to the diameter, correction is usually made only for force (static) unbalance.

For fast, simple, low-cost balancing this Gisholt Type 3S DYNETRIC Balancing Machine is used. It is easily set up to measure and locate force unbalance. The strobe lamp flashes on the numbered band and indicates which of the tapped holes provided in the mounting flange plate will receive the correction weight. At the same time, the amount meter tells the operator exactly which weight screw is to be added to bring the part into precise balance.

By eliminating vibration, grinding wheels rotate very smoothly and produce better threads to closer tolerances.

For A Clear Picture . . .

of the various plans under which you can acquire new machine tools, you'll find this a very helpful booklet. It explains and illustrates time-buying and leasing methods to show how you can benefit from these methods. Write for Booklet P-1173.

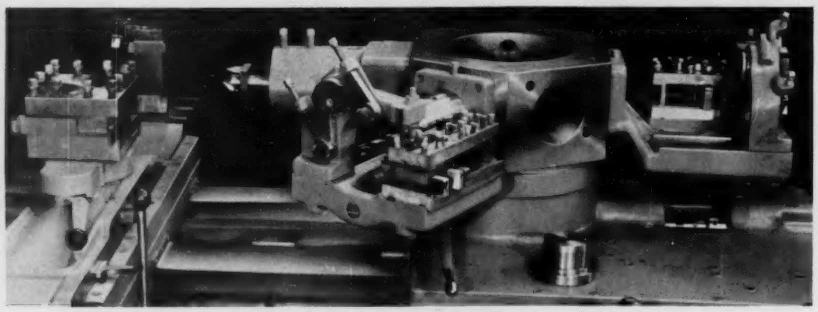
Balancing, performed on new wheels and after dressing old wheels, assures accuracy and improves performance.

DYNETRIC BALANCERS — GISHOLT — DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION. "DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

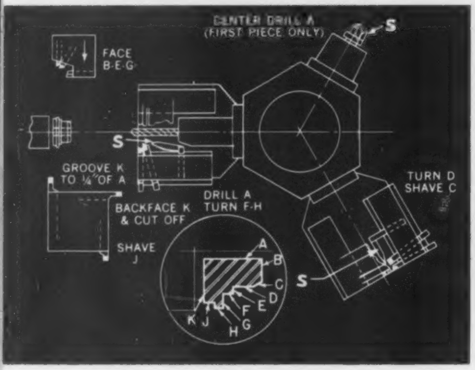
Complete courses covering all phases of precision balancing are offered by the *Gisholt Balancing School.* Get details and starting dates.

TIME-
SAVING
IDEAS

MULTIPLE TOOLING ANSWERS SMALL LOT PRODUCTION



This tooling arrangement makes an ideal setup for the various machining operations shown in the layout. As few as five pieces per lot are handled economically this way.



Saddle Type Lathe Produces Coupling Hubs Faster, More Accurately

Here a standard Gisholt 3L Saddle Type Turret Lathe is multiple tooled with lots as few as five pieces handled economically. The lathe is equipped with a bridge-type cross slide and is tooled to machine steel flexible coupling hubs from bar stock.

All tooling for the several different sized parts is pre-set. This includes the group of tools on the rear of the cross slide and also the special tool blocks held in the multiple cutter turners on the hexagon turret. To go from one part size to another, the operator merely changes these special tool blocks and adjusts the multiple cutter turner rollers. Special stops "S" on turret tooling determine the length of all turned diameters and shoulder positions directly from the end of the piece. These stops eliminate the time required to set turret stops. Also, a stock stop to position the work prior to starting machining operations is not required.

With this kind of interchangeable pre-set tooling on Saddle Type Turret Lathe, you have a high-production setup which can be used for small lots.

HOW SPOT CHECKING SAVES TIME ON SUPERFINISHING JOBS

Inspection Equipment on Machine Speeds Small Lot Operations

Operator is checking surface finish reading with inspection equipment mounted on Gisholt 51A Superfinisher.

Superfinishing, as you may know, is the process whereby a "controlled" surface finish can be quickly and economically obtained, piece after piece —whether the specified final finish is 50, 30, 10 or 1 micro-inch RMS.

In small job shop operations, various parts are handled and finish requirements vary considerably. This necessitates some means by which the operator can determine when he has produced the specified surface finish on a part.

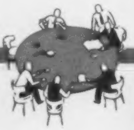
This standard Gisholt 51A Superfinishing Machine is equipped with a Profilometer Unit. This provides a means of instant checking the surface roughness of the part being Superfinished at any time during the Superfinishing operation. The part doesn't have to be removed. It's possible to Superfinish each individual part to the blueprint tolerance before leaving the machine.

Superfinishing is made even more efficient and lower cost with this means of keeping a "running" check on surface roughness. It's ideal for handling small lots and where different surface finishes are specified.

Write for book, "Wear and Surface Finish" which gives full information on Superfinish.

No. 5-655
639

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

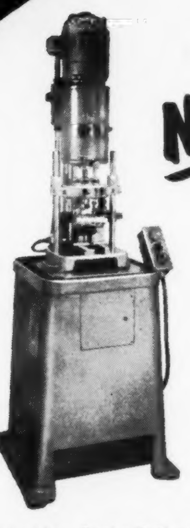


GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

NOW ...an all electric completely self-contained lead screw tapping unit that needs no reversing motor



A.T.U. No. 3 Lead Screw Tapping Machine with Ettco-Emrick multiple spindle head and work holding fixture—the ultimate in tapping speed and economy.

A.T.U. No. 3 Lead Screw Tapping Unit with Ettco-Emrick multiple spindle tapping head.

New ETTCO-EMRICK A.T.U. No. 3
with forward and reverse electric clutches

Fastest, most accurate and simplest method of lead screw tapping yet devised! The Ettco-Emrick A.T.U. No. 3 Unit utilizes a new principle of instantaneous acting electromagnetic forward and reverse clutches to make the tapping operation as easy and as automatic as it could possibly be. Check these features:

1. All electric operation and control — no cams, no air, no hydraulic systems. Easily synchronized to any machine.
2. No reversing motor required — electro-magnetic forward and reverse clutches control tap direction.
3. Built-in rheostat control permits torque of clutches to be adjusted over a range of from 0 to 2 hp to give sensitivity required to protect smallest taps yet assures sufficient power and torque to drive the larger taps.
4. Thread depth control to within ¼ turn of the tap.
5. Lead screws and nuts for different pitches which can be quickly and easily interchanged simply by removing two set screws.
6. Unit can be operated in any position — horizontal, vertical, at any angle.

In addition to single spindle operation, the basic A.T.U. No. 3 Unit can be incorporated into a variety of tapping set-ups using Ettco-Emrick fixed or adjustable spindle multiple heads, work holding fixtures, etc. to meet an almost limitless range of tapping and threading requirements.

Bulletin No. A.T.U. has details. Send for a copy.

ETTCO TOOL CO., INC.

Ettco-Emrick

592 Johnson Ave., Brooklyn 37, New York

Chicago • Detroit • Menlo Park, Calif. • Worcester
Distributors throughout the U.S. and Canada

TAPPING ATTACHMENTS • MULTIPLE HEADS • TAPPING MACHINES • INDEXING FIXTURES • TAP AND DRILL CHUCKS

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For more information on products advertised, use Inquiry Card, page 253

your best bet... BSA single spindle automatic screw machines

for fast, economical single spindle bar work up to 2" diameter

The 2" BSA Single. Note open operating area for ample chip clearance and tooling accessibility.

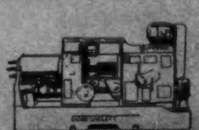
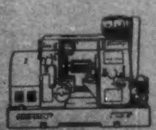
- BSA Tools Ltd. of England, one of the world's oldest and largest machine tool builders, have produced and distributed thousands of these BSA "Singles" since they introduced them in 1926.
- Available in five standard capacities: ½", ¾", 1", 1⅝", and 2".
- All models use STANDARD AMERICAN TOOLING.
- Wide range of spindle speeds —200 to 6000 on ½" machine, 69 to 1260 on 2" model.
- Cams, change gears and tooling easily accessible for quick job-to-job changeover.
- Unit construction provides quick access for easy maintenance.
- Special spindle mounting, designed to reduce wear.
- Cross slides and turret mounted on replaceable ways.
- Positive chain drive from gear box to spindle prevents slippage.

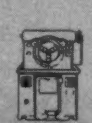
distributed and serviced in U.S.A. by NATIONAL ACME

Since their introduction in this country, BSA Single Spindle Automatic Screw Machines have enjoyed remarkable acceptance. Combining latest automatic screw machine principles with proven design, they have produced at top standards of speed and accuracy with minimum upkeep.

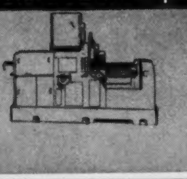
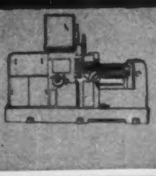
BSA "Singles" are distributed and serviced in the United States by National Acme, in Cleveland, where adequate replacement parts are stocked —and you get the same active, experienced and interested service support as that on which National Acme's reputation has been built.

For specifications on all sizes, write for Bulletin BSA-54



OUR JOB: to provide the *Right Machine* for **YOUR JOB**

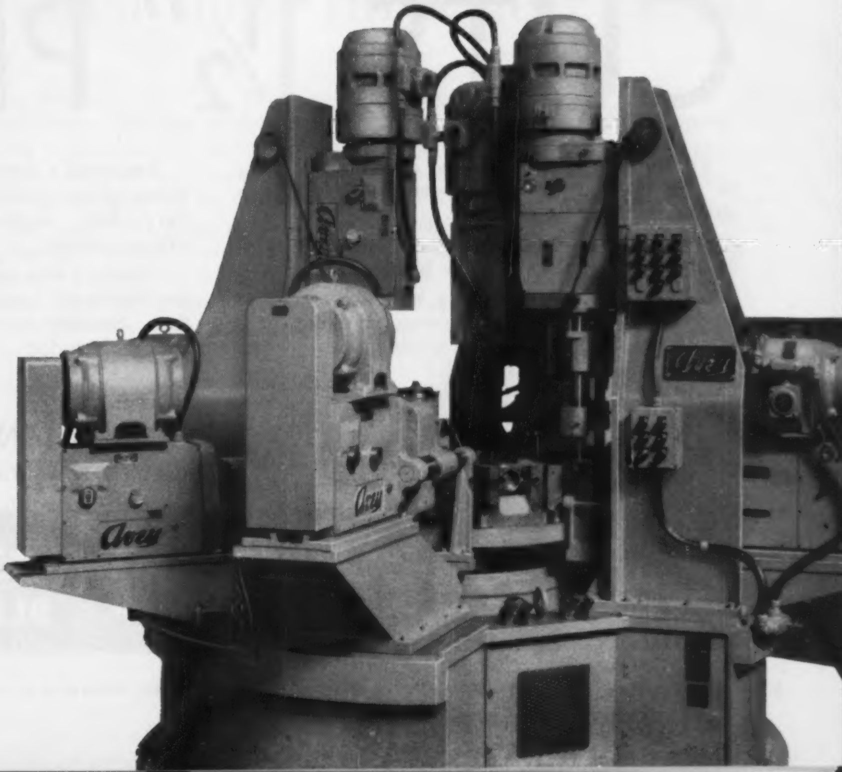



Acme-Gridley 4, 6 and 8 Spindle Automatic Bar and Chucking Machines • Fully Automatic Turret Lathes (Bar and Chuck Type) • Hydraulic Thread Rolling Machines • Automatic Threading Tools • Switches • Solenoids • Contract Manufacturing.

THE NATIONAL ACME COMPANY

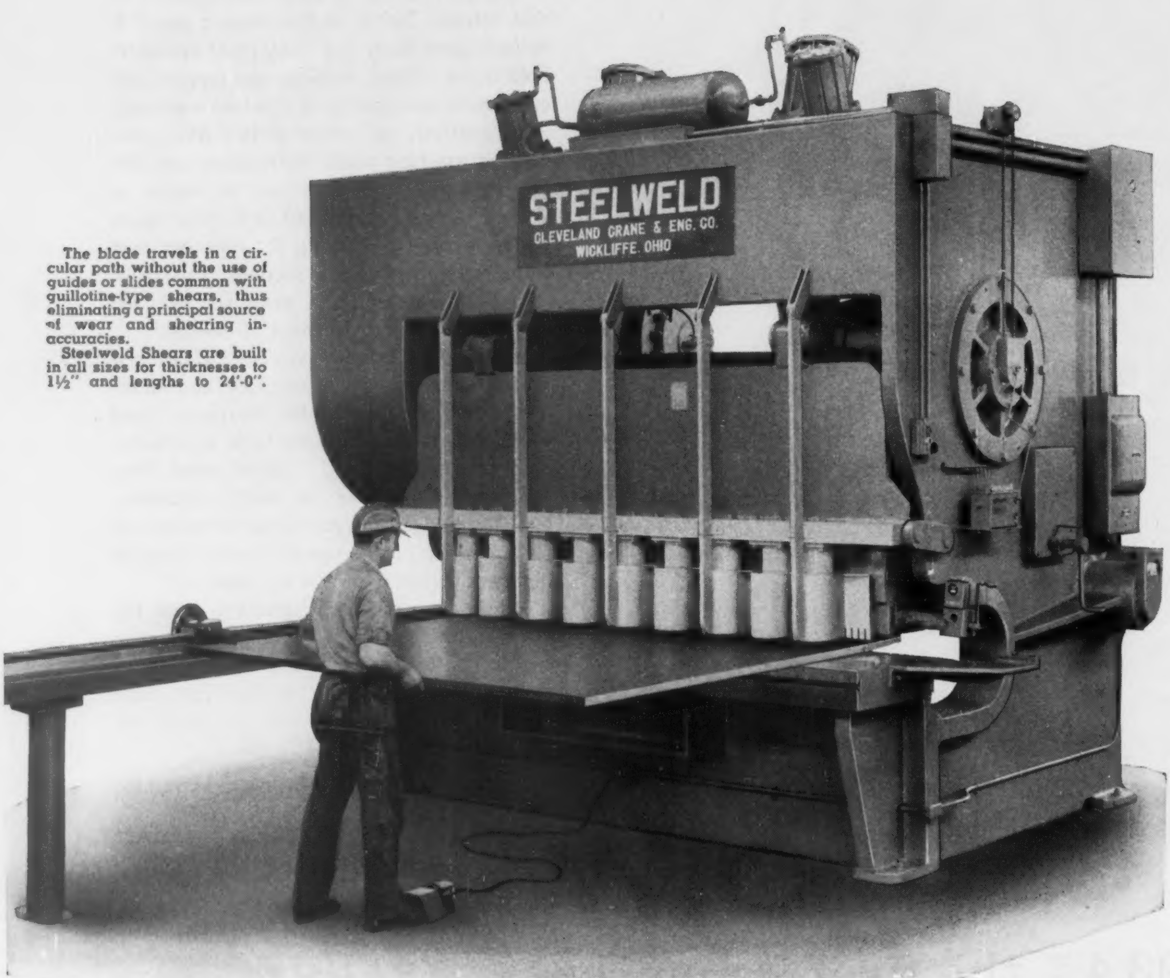
179 EAST 131st STREET • CLEVELAND 8, OHIO

milling, drilling, tapping machine yields



The blade travels in a circular path without the use of guides or slides common with guillotine-type shears, thus eliminating a principal source of wear and shearing inaccuracies.

Steelweld Shears are built in all sizes for thicknesses to 1½" and lengths to 24'-0".



CUTS 1½" PLATE

22 cuts per minute can be made in plate up to 1½"x8'-0" with this powerful, heavily constructed shear.

Operation is noticeably quiet because blade counterbalances cushion the blow.

All thicknesses are easily cut with accurate, smooth, burr-free edges because of Steelweld's popular fast micro-set knife adjustment.

Steelweld's low-inertia clutch-brake unit provides quick, positive clutching and braking with very little slippage. Thus heat and wear are minimum.

Carefully size up this machine or any shear in the Steelweld line, and we believe you will agree that Steelwelds are the most outstanding available today.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

5444 EAST 282nd STREET, WICKLIFFE, OHIO

STEELWELD PIVOTED BLADE SHEARS

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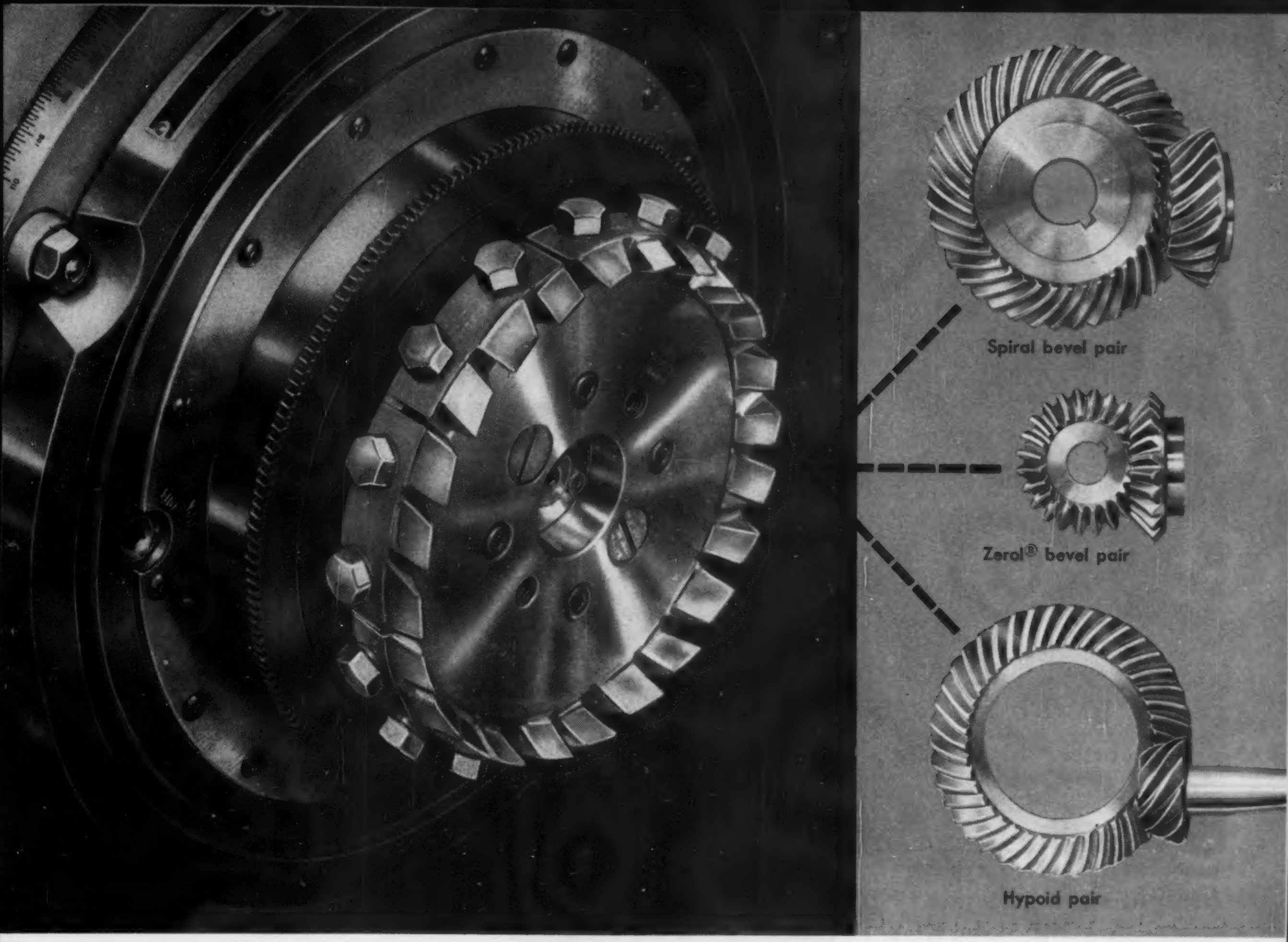

Spiral bevel pair
Zerol® bevel pair
Hypoid pair

AN *All New* ... LOW COST *Acme* THREADING MACHINE *Model XLA*

● A basic, *low cost,* heavy duty threading machine specifically designed for precision threading on the larger sizes of maintenance work. The ACME Model XLA can be easily equipped with those automatic features required to meet your individual needs for quantity production operations. The 60 year tradition of ACME precision and versatility has been maintained.

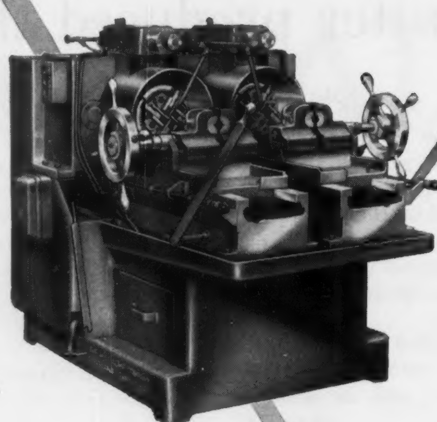
The new ACME Model LLH die head (standard on all ACME Model XLA Threading Machines) will accommodate either radial or tangential chasers.

Manufactured in single and double spindle design in 1″, 1½″, 2″ and 2½″ capacity sizes.

Here is your opportunity to get a precision threading machine with the versatility of more costly equipment at a price within your budget.

HILL ACME TOOLS FOR INDUSTRY

SEND FOR BULLETIN 2-XLA



THE HILL ACME COMPANY

ACME MACHINERY DIVISION • 1209 W. 65th St., Cleveland 2, Ohio
ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

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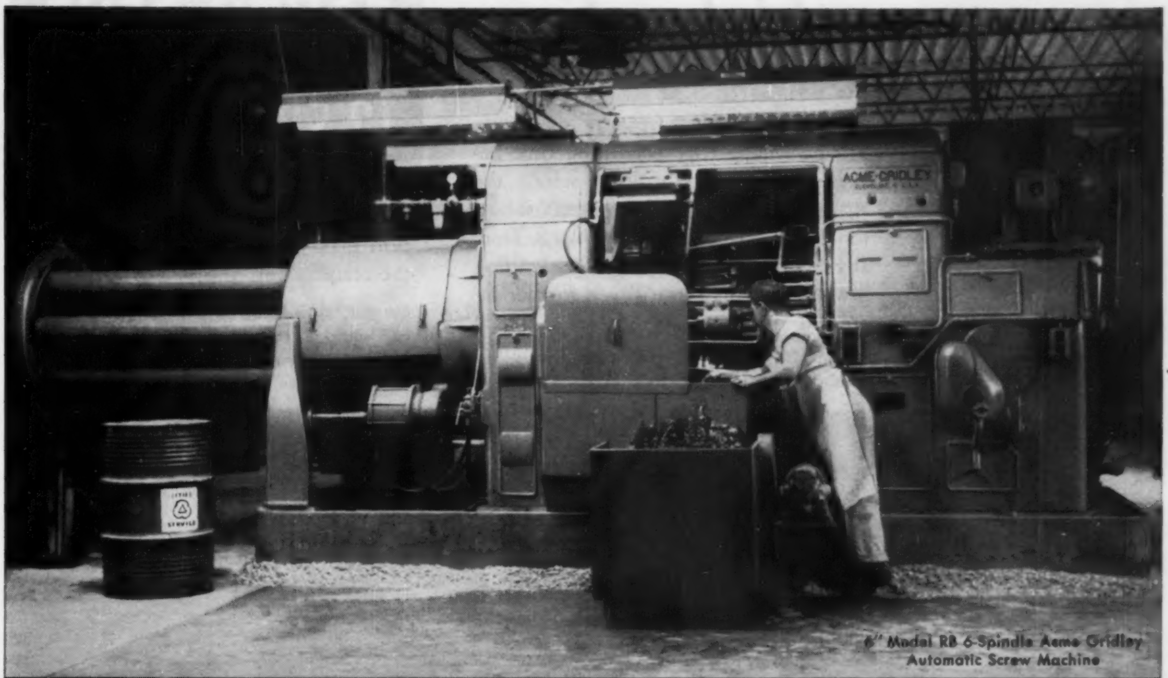


6" Model RB 6-Spindle Acme Gridley Automatic Screw Machine

ONLY 5 MORE LIKE IT IN THE WORLD!

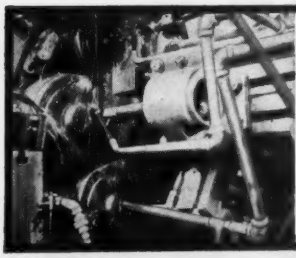
Owned by Jessen Manufacturing Company, today's most advanced automatic screw machine uses Cities Service Cutting and Hydraulic Oil

Weighing 39 tons and powered by a 60 H.P. motor, this 6-inch, 6-spindle Acme Gridley Automatic Screw Machine is one of the only six now in existence . . . and the only one owned by a job shop. Featuring a combination pneumatic-hydraulic operation, it can turn out a single load of stock weighing 3 tons!

The owner is Jessen Manufacturing Company of Elkhart, Indiana—since 1923 famous for keeping on top of new developments. It's not strange, therefore, that for this advanced new machine they chose a top quality coolant—a Cities Service cutting fluid.

Says President J. H. Jessen: "We're happy to say that the Cities Service cutting oil we use today is one of the finest all-around cutting oils we have ever used. In years past, we felt that if a cutting oil was good, it had to be black, heavy, and odorous. Cities Service has changed our minds with a cutting oil that has outstanding cooling abilities, good chip drain-off, is anti-weld . . . and yet possesses light, clear color and has no noticeable odor. In addition, Cities Service Pacemaker Oil used in hydraulic systems, and Amplex Lubricating Oil are doing an outstanding job throughout our shop. We proudly recommend _all_ these Cities Service Oils."

For more information on the complete line of Cities Service cutting fluids, call in a Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.



Light, Clear Coolant in Acme-Gridley Automatic is Cities Service cutting oil. "Outstanding cooling, anti-weld, and chip drain-off ability," says Jessen. Firm also praises Pacemaker Oils, used in their hydraulic operations.

Jessen Mfg. Company., Inc. Mr. Jacob Jessen, Pres., in business since 1923, has earned reputation of keeping on top of new developments. In 1935, he was one of the first to install 6-spindle, anti-friction bearing screw machine.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

For more information on products advertised, use Inquiry Card, page 253

For more information on products advertised, use Inquiry Card, page 253

3 Reasons Why

Taft-Peirce Superpower Magnetic Chucks Save You Money

1 — You get the "right" chuck for every job. T-P offers you a complete line of *both* Electromagnetic and Permanent Magnet Chucks. A P-M Chuck has no wires to fail . . . no current to heat . . . it's the safest, most economical choice for many jobs. Ideal for grinding, light milling, planing, shaping, and bench work. Since we also make electromagnetic chucks, we'll be glad to advise you which is best for your job.

2 — T-P Cost-Cutting Designs. T-P offers you a selection of work-saving models — in practically all standard sizes and shapes. Maybe you need a T-P Superpower Chuck that tilts or swivels to save setup time. Or a fine mesh chuck to hold small or thin sections. Or a longitudinal pole chuck for greater versatility. Taft-Peirce makes them all and many more. Plus practically any special design you may need.

3 — Maximum Power and Performance. Taft-Peirce Superpower Magnetic Chucks combine maximum holding power with maximum working surface. Magnetic losses are low. Safety factors generous. Rugged, rigid, one-piece all-steel body is waterproof and shockproof. Little or no maintenance is ever required.

For information on Superpower Chucks and other items send for your copy of the Taft-Peirce Handbook.

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

POINT *sooner than you think...*

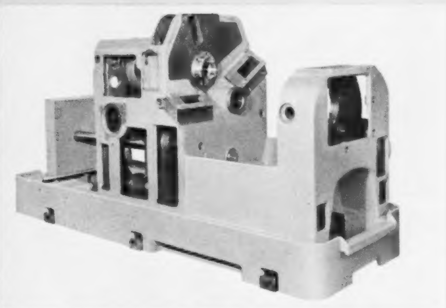
when you put the job on an Acme-Gridley

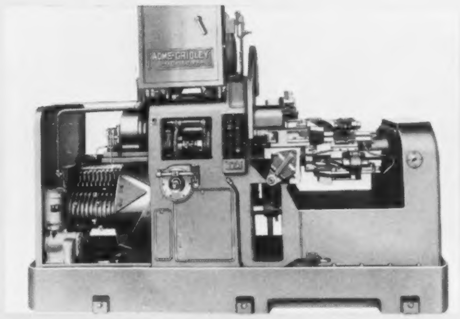
Fully Automatic

BAR OR CHUCK-TYPE TURRET LATHE

• Actual job tests have shown that with Acme-Gridley Fully Automatic Turret Lathes you can profitably use automatic production on shorter runs than formerly was thought possible. The reason? Automatically Controlled Cycle.*

• By completing the maximum number of operations in one *automatically-controlled* cycle — and doing it faster, more accurately and at the same predetermined rate throughout the entire run, tooling time becomes of less relative importance. *You get to the break-even point in cost per piece, sooner than you think.* And it doesn't require much imagination to visualize how these savings multiply on longer production runs.

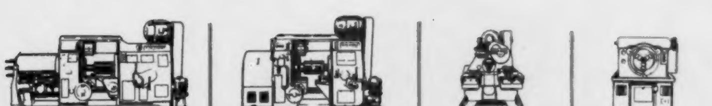




HUSKY BASIC FRAME: A well-balanced structural design with weight properly distributed to provide rigid support for tool slides and work spindle — sustaining alignment and accuracy at spindle speeds and feeds imposed by modern carbide and high speed tooling. Turret outer support, containing independent indexing mechanism, is secured to headstock by heavy side walls. A heavy column supports main drum shaft at other end of the pan.

AUTOMATICALLY CONTROLLED CYCLE: Easy to set, easy to use. Accessibility of cycle control drum and tool-slide camming provides quick job changeover. Convenience of controls and "working height" reduces operator fatigue. In the open tooling zone, each tool-slide (cross slides and 5 turret slides) is carefully designed and positioned to provide maximum support for the tools without excessive overhang — on the turret, only the "working" slide advances to the work, providing closer support of tools and permitting wider cross slides to operate simultaneously without interference.

GREATER TOOLING ADAPTABILITY: Independent operation of each cross slide and turret slide permits balancing of correct spindle speed and tool feed for various cuts. Independent turret slide indexing permits overlapping operations — two or more shorter end working operations may be performed while forming cuts, requiring longer machining time, are simultaneously continued by the cross slides.



OUR JOB: to provide the *Right Machine* for **YOUR JOB**

Acme-Gridley 4, 6 and 8 Spindle Automatic Bar and Chucking Machines • Fully Automatic Turret Lathes (Bar and Chuck Type) • Hydraulic Thread Rolling Machines • Automatic Threading Tools • Switches • Solenoids • Contract Manufacturing.

THE NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

For more information on products advertised, use Inquiry Card, page 253

For more information on products advertised, use Inquiry Card, page 253

Farval cuts cutter shutdown time, boosts paper output 22,500 lbs.

FARVAL—
Studies in Centralized Lubrication
No. 166

BY contributing to uninterrupted operation in paper cutting, Farval Centralized Lubrication helps to keep production up and costs down.

The trimming operation pictured is a typical Farval installation in a modern mill. Positive, periodic lubrication is provided for the 61 bearings on the trimmer, once every shift. If the cutter were shut down for lubrication by hand, it would take 1½ hours, resulting in a loss of 22,500 lbs. of paper output.

Lubricates machines while operating

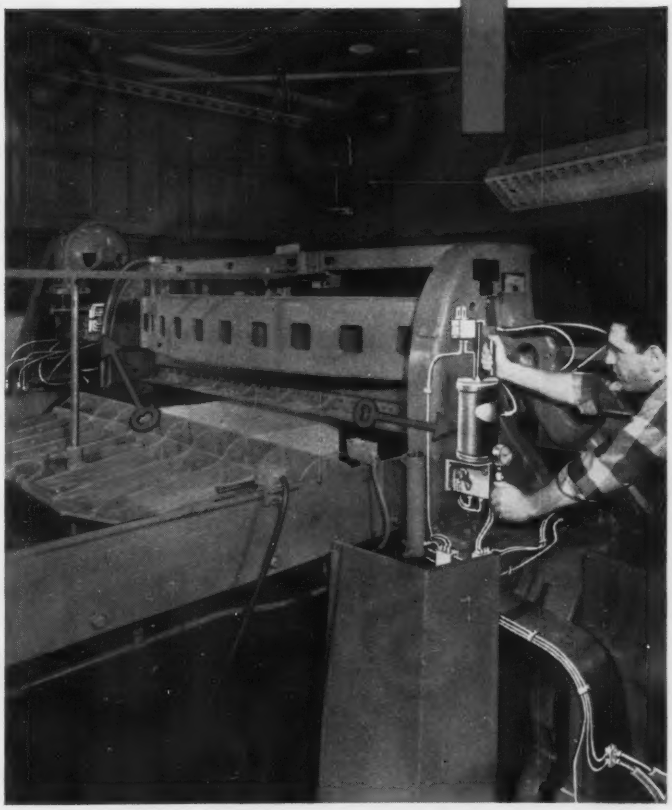
With the simple, dependable Farval system, bearings are lubricated quickly, *without* shutdown, from one central pumping station. Farval delivers oil or grease to each bearing served as needed, in the exact amount required—no more, no less. Equipment is protected, time and labor costs are reduced, steady production is maintained.

Farval Centralized Lubrication Systems, manual or automatic, can be installed easily on old or new equipment. They're making big savings in time, labor, lubricant and increased machine output in thousands of installations, in practically all industries.

Write for free bulletin

It will pay you to find out how Farval can save money for *you,* and pay for itself many times over! Let's talk over your equipment lubrication problems, or write today for Bulletin 100. The Farval Corporation, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.



Farval manual lubrication system on a 94" Seybold Trimmer, Model 152 at the Hammermill Paper Company, Erie, Pa., saves time and money, helps maintain high, steady production.

KEYS TO ADEQUATE LUBRICATION—Wherever you see the sign of Farval—the familiar central pumping station, dual lubricant lines and valve manifolds—you know a machine is being properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.

FARVAL
CENTRALIZED SYSTEMS OF LUBRICATION

NEW

PRECISION WAY to hob gears up to 23 ft. diameter

SCHIESS RF GEAR HOBBERS

Tremendous! Yes—and newly designed! Cut mammoth gears from 9 ft. to 23 ft. diameter with "lightweight" precision! Spur, helical and herringbone gears (including internal gears). Also wormwheels of either low- or high-lead angle.

Accurately centered fixed table supports blanks ranging from 20 to 80 tons. Moving column adjustable for both diameter of gear and depth of tooth. Cuts in either upward or downward direction. Huge master wormwheels assure accuracy of indexing movement. Tooth pressures of worms offset each other—no lateral stress.

SPUR GEARS cut by driving work table through index change gears connecting with hob spindle drive.

SINGLE HELICALS (or double helicals with teeth separated by gap) produced by additional table movement—by means of differential gear provided with change gears.

HERRINGBONES cut with end mills by means of single indexing method. Additional table motion achieved by same method used in helical hobbing.

WORMWHEELS for low-lead angle usually cut with parallel hobs by radial feed method. High-lead angles cut with tapered hobs and axial feed.

Four standard models—9′ 10″, 13′ 2″, 18′ and 23′ diameters. Products of Schiess, Europe's largest builder of heavy machine tools. Parts and service as close as Pittsburgh. An American Schiess engineer will be happy to help you decide how these heavy producers can serve your heavy production needs. Write for catalogs and complete specifications on all Schiess RF models.

Schiess Model RF 50/55
Gear Hobbing Machine
cutting a 10½ ft. helical gear.

Engineering Division
AMERICAN
SCHIESS
CORPORATION
38th Street and AVRR, Pittsburgh, Pennsylvania

Sole Distributor
KURT ORBAN
COMPANY, INC.
34 Exchange Place, Jersey City, N. J.

For more information on products advertised, use Inquiry Card, page 253

TAPS *and* GAGES *by* CARD

Now, Card brings you a select line of gages along with renowned Card taps. You can specify and use both with complete confidence, knowing that whatever the job demands, you'll get top performance. We assure you that the new line of gages boasts the same quality of manufacture that has made Card taps famous over the past 81 years.

Contact your local Card Distributor for prompt deliveries and helpful service.

The CARD Quality

S. W. CARD MANUFACTURING CO. MANSFIELD, MASS.

Division of Union Twist Drill Co. TAPS · DIES · SCREW PLATES · GAGES

For more information on products advertised, use Inquiry Card, page 253

HOW THE "BUFFALO" "Q" Factor* GIVES YOU THE BEST DRILLING BUY

A CASE IN POINT—
THE "RPMster" DRILL OF 1001 SPEEDS

Variable speed drive operates with motor running.

Replaceable Motor—not practical with motor spindle drills.

6-spline alloy steel spindle mounted in precision ball bearings of sufficient size to carry both radial and thrust loads.

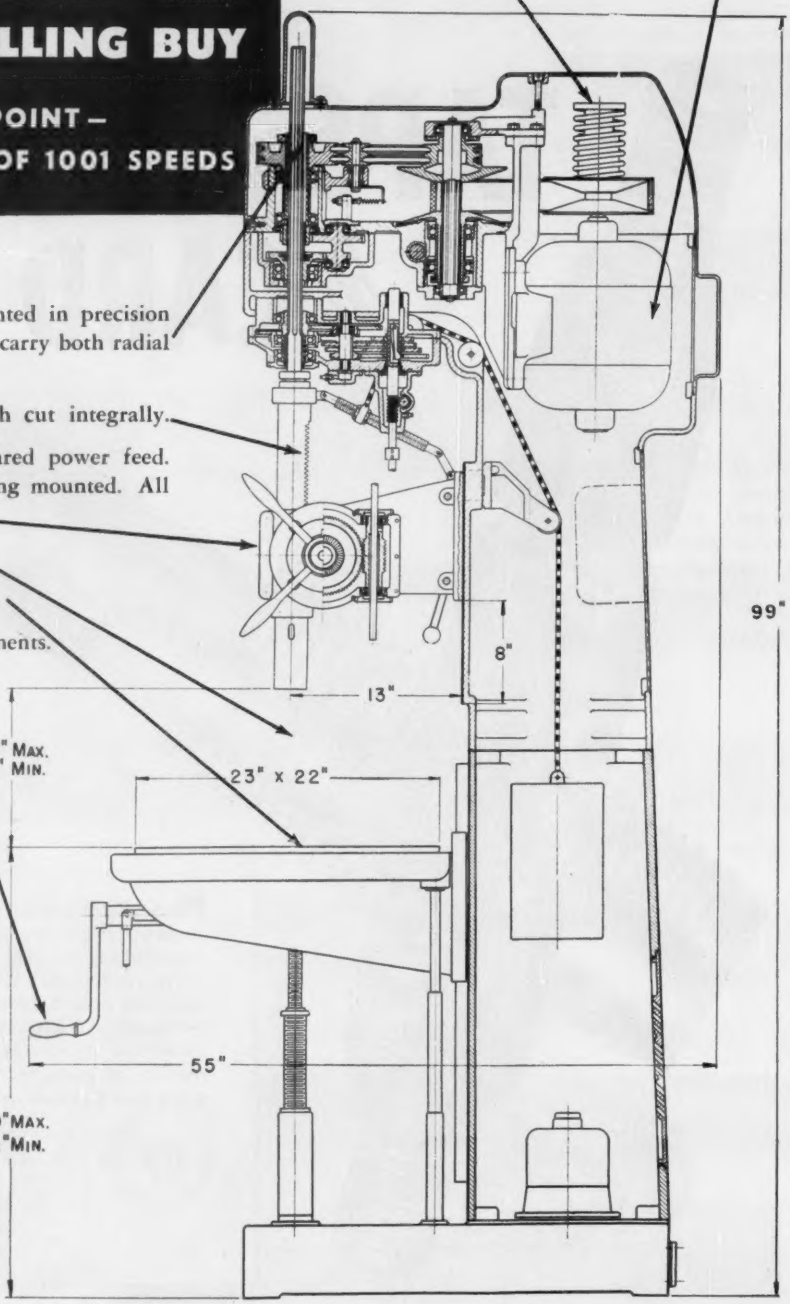
Alloy steel quill with rack teeth cut integrally.

Sturdy, simple, foolproof all-geared power feed. Alloy steel back gears ball bearing mounted. All controls easily reached.

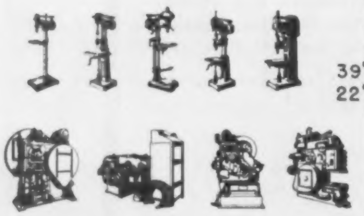
Maximum space for your work.

500 square inch working surface.

Convenient crank or lever adjustments.



*These are just a few of the features that go into the "Buffalo" "Q" Factor — the built-in Quality that provides trouble-free satisfaction when you specify "Buffalo". Write for Bulletin 3257B for further details on this top drill value!



The Machine Tool Show
Chicago, Ill., Sept. 6-17, 1955

"Buffalo"

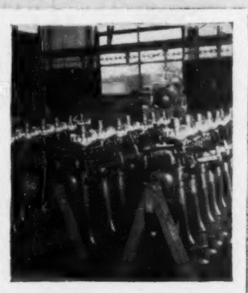
BUFFALO FORGE COMPANY
440 BROADWAY BUFFALO, N.Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING • PUNCHING • SHEARING • BENDING

For more information on products advertised, use Inquiry Card, page 253

Not A Ski Lift, but an assembly line, used by Clinton to transfer engines from one building to another. There are 10 basic models ranging from 1.6 to 9 horsepower, and 10 Cities Service products help to make them.

"3,000,000 ENGINES IN EIGHT YEARS... CITIES SERVICE PLAYED MAJOR ROLE."



Outboard Motors are one of the chief products of Clinton Machine Company. Others include chainsaws and many types of gasolene engines for small power requirements.

Phenomenal is the word for Clinton Machine Company, Clinton, Michigan. Formed in 1946, it has expanded so rapidly that today it claims second place among U. S. producers of air-cooled gasolene engines and has already marketed 3,000,000 of these and other engines.

Were there lubrication problems? Of course. "But," says President Don Thomas, "I am happy to say they have continually been taken care of by Cities Service from the very beginning. In these formative years, Cities Service engineers came to our plants and recommended the proper lubricants for both our production machinery and the products we make.

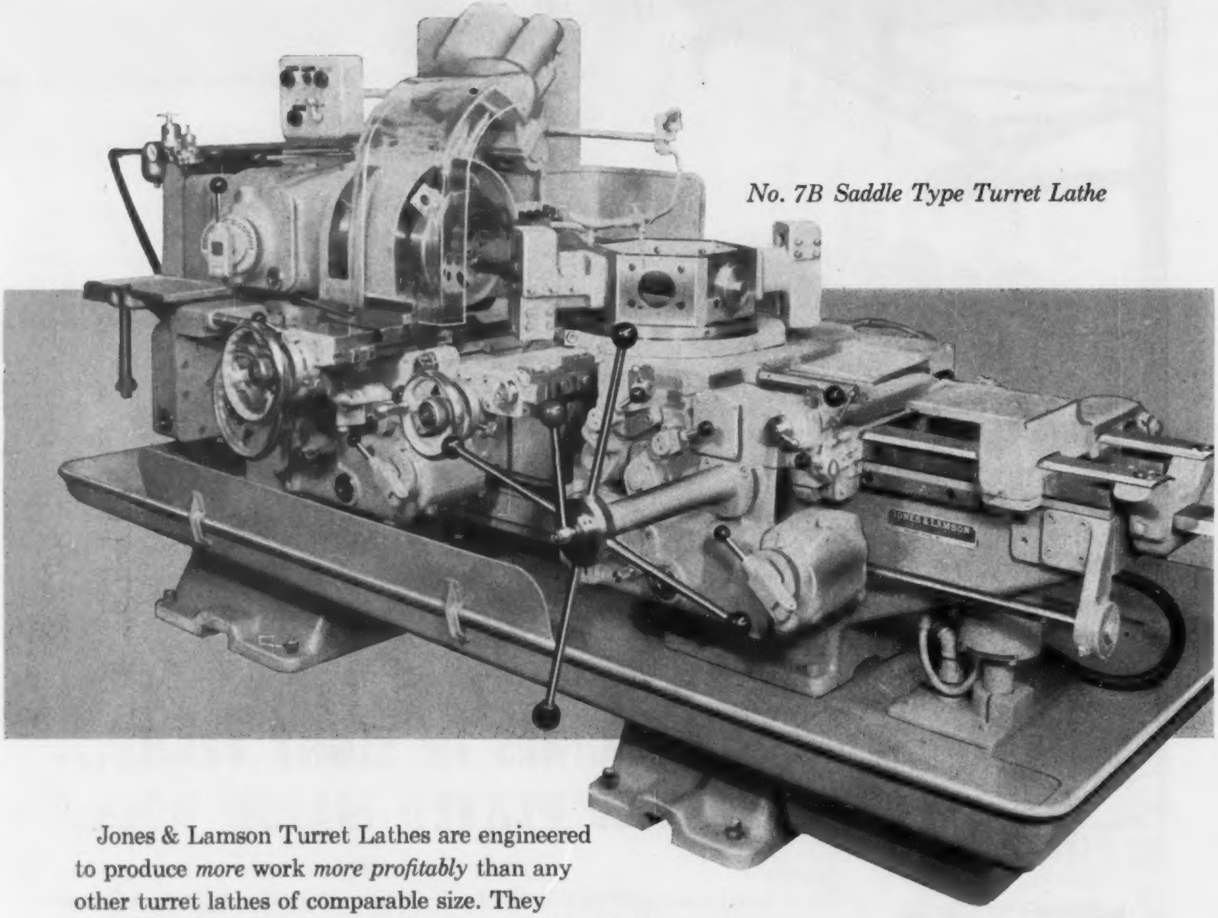
Thus, for the past eight years, we've used Cities Service Chillo Cutting Oils, Trojan Greases and Pacemaker Oils with complete satisfaction. We don't hesitate to say that the cooperation and outstanding service offered by Cities Service plus the quality of its products has played a major role in helping us build the Clinton Machine Company."

Time and again manufacturers like Clinton report unusual results using Cities Service Lubricants. Find out why. *You* may profit, too. Talk with your local Cities Service Lubrication Engineer or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Engineered for Precision...
Powered for Production...



No. 7B Saddle Type Turret Lathe

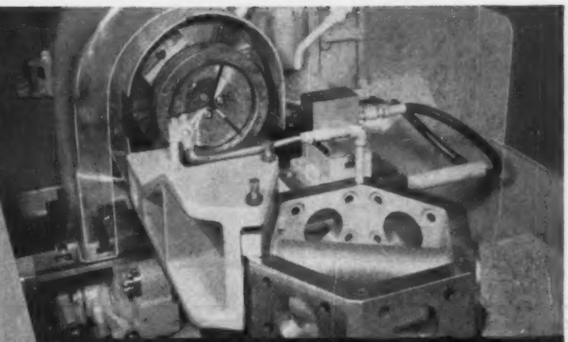
Jones & Lamson Turret Lathes are engineered to produce *more* work *more profitably* than any other turret lathes of comparable size. They have the rugged, rigid construction that makes possible greater accuracy and the use of Hi-Velocity turning; and they incorporate many superior features that assure PRODUCTIVE CAPACITY unmatched in its class. Adequate spindle speeds and horsepower insure the proper use of carbide cutting tools at surface speeds of 650-750 feet per minute.

J&L JONES & LAMSON MACHINE COMPANY

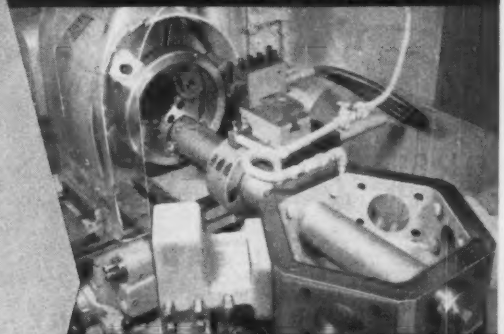
Jones & Lamson offers you a choice of methods for acquiring modern, profit-producing J & L equipment. In addition to outright purchase, J & L makes available several different "Pay-From-Productivity" plans at interest rates of 3¼% and lower (add-on), and a broad variety of lease plans.

Send today for complete details on J & L's machines, methods and Procurement Plans. Simply fill in the coupon, clip it to your letterhead and mail.

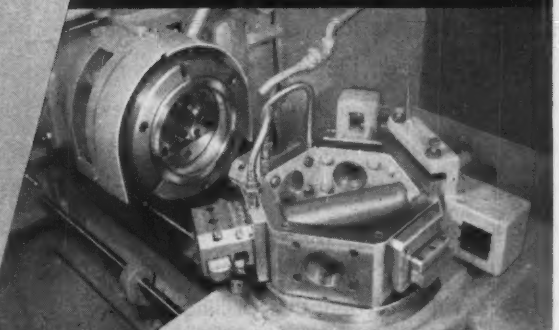
and capable of doing jobs like this...



First Operation: One tool mounted on the Hex Turret turns the O.D. while a tool mounted on the rear of the cross slide faces one end. At the end of the facing cut, the radius on the O.D. is formed. Floor-to-floor, 1.94 min.



Second Operation: Location is taken from the two previous finished surfaces. Boring and I.D. chamfering are performed by using tools mounted on the Hex Turret while facing and forming of the O.D. are finished by tools mounted on the rear of the cross slide. Floor-to-floor, 2.57 min.



Third Operation: Special wrap-around jaws mounted on a power operated three-jaw scroll chuck are used for holding the finish turned ring when grooving. The groove is formed by a radius tool held in a bar mounted on the Hex Turret (this applies to internal or external straight or taper races). I.D. is also chamfered in this operation. Floor-to-floor, 1.67 min.

Machine tools do not pay dividends unless they are cutting metal. Engineering the tooling around the parts to be produced reduces the setup time to a minimum, and in many cases doubles the production per labor hour.

In this case high production methods of tooling for automatic lathes were simplified and applied to three 7B J&L Universal Saddle Type Turret Lathes. Inner and Outer Ball Bearing Races and Roller Bearing Races are produced on the same machines. Setup time from one lot to the next does not exceed fifteen to twenty minutes per machine.

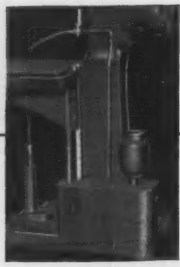
MACHINE TOOL DIVISION

UNIVERSAL TURRET LATHES • FAY AUTOMATIC LATHES • AUTOMATIC DOUBLE-END MILLING & CENTERING MACHINES • AUTOMATIC THREAD & FORM GRINDERS • OPTICAL COMPARATORS AUTOMATIC OPENING THREADING DIES & CHASERS

512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

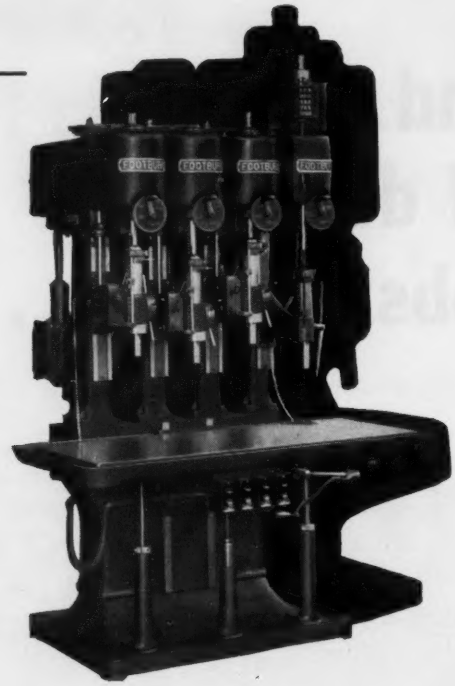
Jones & Lamson Machine Company
512 Clinton St., Dept. 710, Springfield, Vt., U. S. A.
Please send me the J & L Machine Tool Replacement Information Kit.
*Name*____________________
*Title*____________________

For more information on products advertised, use Inquiry Card, page 253



FOOTBURT *Sensitive*

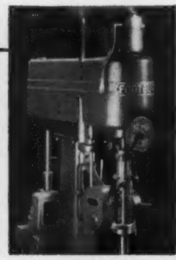
DRILLING MACHINES



A FULL RANGE DRILLING MACHINE ENGINEERED FOR PRODUCTION

■ No. 2 Machine with Back Gear • 12″ Overhang • ⅝″ Drilling Capacity in Steel • Optional Speed Ranges • 185 to 2300 RPM • 280 to 3450 RPM • Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit.

■ Built carefully to provide the required accuracy for fine tool room work, Footburt Sensitives are designed with the weight and stability to maintain close tolerances on day after day production work. The correct speed for a wide range of drilling, reaming, and counterboring operations is instantly available. Write for full information on this great line of Sensitive Drilling Machines. Built in 1, 2, 3, 4, 6 Spindle Models.



THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building

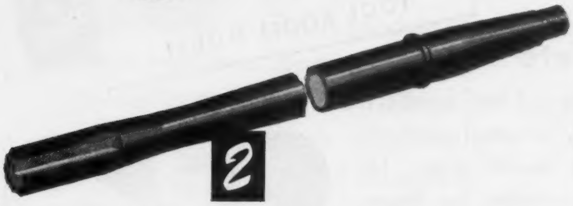
engineered for production **FOOTBURT**
MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 253

7 WAYS to SAVE MONEY with TOCCO* Induction Hardening

1

Cost was reduced 94% when heat-treatment of this corn-harvester part was changed from carburizing to TOCCO-hardening, 9½c saved on every piece — $4750 on each 50,000 piece batch, plus an hourly production increase from 120 to 300 pieces per hour.



2

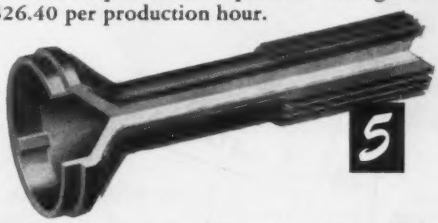
$375 per day! When Salisbury Axle switched to TOCCO-hardening axle shafts. Less machining—30 seconds instead of 2 minutes—means lower tool cost. Also production zoomed from 50 to 120 per hour. TOCCO hardened shafts have 200% greater torsional life.

3

Kearney & Trecker Corp. reduced the cost of hardening this milling machine part from $1.57 to 10c apiece. In addition TOCCO made possible a switch from alloy to S.A.E. 1045 steel—saving another 11c per piece in material cost. Kearney & Trecker hardens 140 different parts on one TOCCO unit.

4

Thompson Products Ltd. boosted production of these automotive wrist pins from 500 to 1200 per hour when they switched to TOCCO-hardening. Costs fell from $5.45 to $3.25 per hundred parts—a savings of 2c per pin, $26.40 per production hour.



5

Mechanics Universal Joint Division of Borg-Warner reports a 69% savings in the hardening of stub ends for propeller shafts. TOCCO also upped production from 35 to 112 parts per hour—over three times as fast as conventional heating methods.

6

Lima-Hamilton Corporation adopted TOCCO for hardening this shifting lever. Results: a savings of 4c per piece—$25 per production hour. TOCCO costs only 17% of former heating method. This is only 1 of 139 parts TOCCO-hardened by Lima-Hamilton Corp. All show savings over usual heating methods.

7

Number 7—the lucky number—is up to you. Why not add your name to the list of companies who use TOCCO Induction Heating to increase production, improve products and lower costs. TOCCO engineers are ready to survey your plant for similar cost-saving results—without obligation, of course.

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-5, Cleveland 1, Ohio

Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

Name____________________

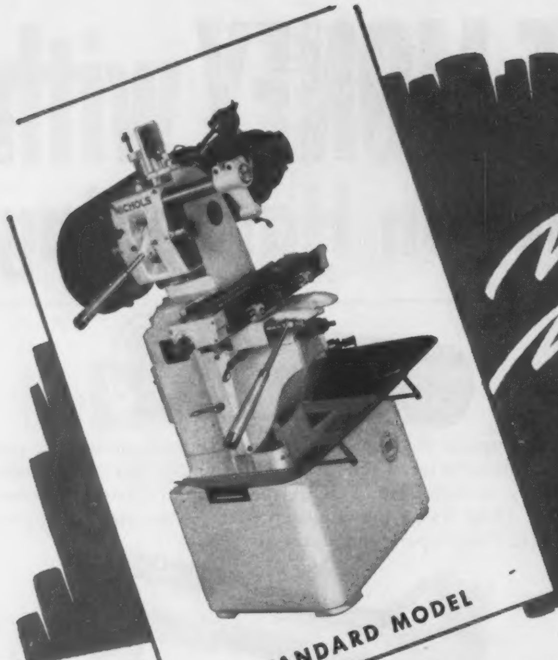
Position____________________

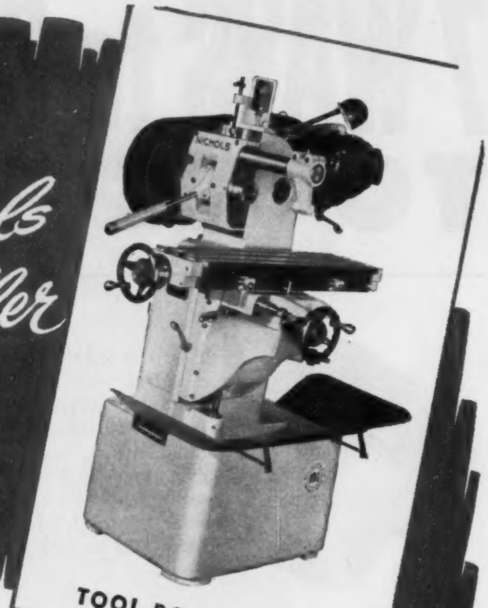
Company____________________

Address____________________

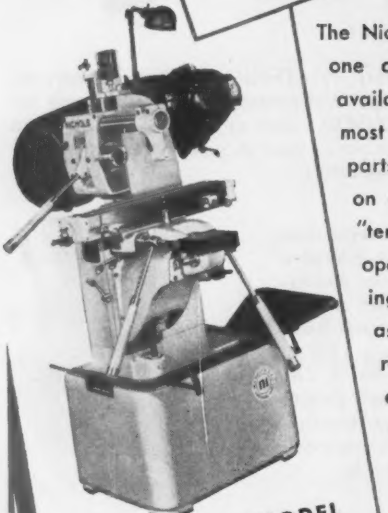
City________ Zone____ State______

Nichols Miller

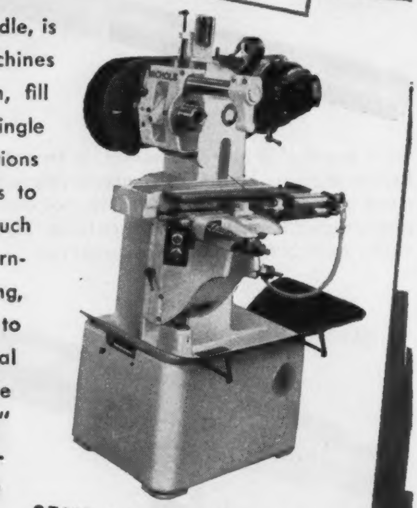

STANDARD MODEL


TOOL ROOM MODEL

. . . a *complete* line


PRODUCTION MODEL

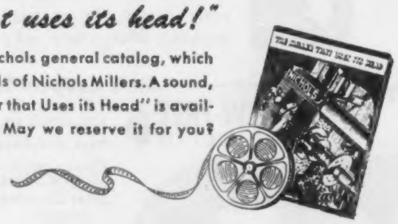
The Nichols Miller, with "rise-and-fall" spindle, is one of the most precise, universal machines available today. The four models shown, fill most basic requirements—whether for single parts with simple set-up, or multiple operations on mass production jobs with tolerances to "tenths". Their versatility makes possible such operations as facing, boring, recessing, turning, slotting, key seating and contour milling, as well as regular milling. According to requirements, screw or lever longitudinal and transverse table feeds are available optionally. "The miller that uses its head" is your best choice—and one of industry's greatest values. If you want production to "tenths", investigate the Nichols Miller.


SEMI-AUTOMATIC MODEL

ni

"the miller that uses its head!"

Write today for the Nichols general catalog, which describes the six models of Nichols Millers. A sound, color movie "the Miller that Uses its Head" is available for free showing. May we reserve it for you?



CONDENSED SPECIFICATIONS

Table Working Surface	6¾" x 21" or 30"
Longitudinal Travel (screw or lever)	10" or 19"
Transverse Travel (screw or lever)	7"
Vertical Travel — Knee	13½"
Rise and Fall of Spindle	4½"
Selective Speed Ranges up to 5000	R.P.M.
Weight	1250 lbs.

MANUFACTURED BY W. H. NICHOLS COMPANY WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS **NICHOLS-MORRIS CORPORATION**

**76-E MAMARONECK AVE.
WHITE PLAINS, N. Y.**

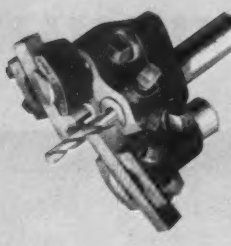
For more information on products advertised, use Inquiry Card, page 253

your most economical move

RIGHT R and LEFT L TOOLS

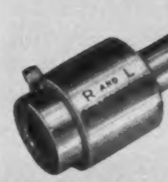
Realizing that a Screw Machine or Turret Lathe is only as good as the tools used on it, leading manufacturers* supply R and L TOOLS as original equipment with their machines. Get the most from *your* machinery . . . change to R and L TOOLS now! They'll pay for themselves *and the replaced tools* in no time through reduced set-up time and greater precision.

*List of manufacturers supplied on request.



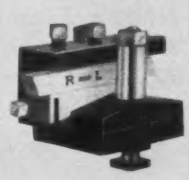
R and L TURNING TOOL . . .
replaces an assortment of 14 different tools costing more than five times as much as this ingenious tool . . . It changes from right to left turning, (or vice versa), in 10 seconds.

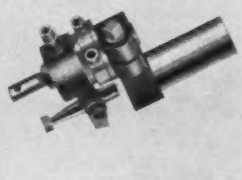
R and L TAP AND DIE HOLDERS . . .
feature a new release mechanism, (exclusive with R and L), which makes right or left threading possible.



R and L KNURLING TOOL . . .
Half the weight . . . twice as efficient as other knurling tools . . . One hex wrench makes all adjustments, thereby cutting set-up time to a minimum.

R and L UNIVERSAL TOOL POST . . .
For use with square or flat tools, it can also be used for holding skiving tools, completely adjustable for use on front or back of cross-slide.





R and L RECESSING TOOL . . .
Newly designed . . . adjustable to operate on both internal and outside diameters, with spindle running right or left. It can be adjusted to handle any diameter within capacity of the machine.

Write for new catalog

R and L TOOLS
1825 BRISTOL ST.
PHILADELPHIA 40, PA.

☐ Please send me your new catalog
☐ Please arrange for no-obligation demonstration of R and L TOOLS

NAME ....

COMPANY ....

ADDRESS ....

M-5

CLIP AND MAIL THIS COUPON TODAY

RIGHT R and LEFT L TOOLS
1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) • UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

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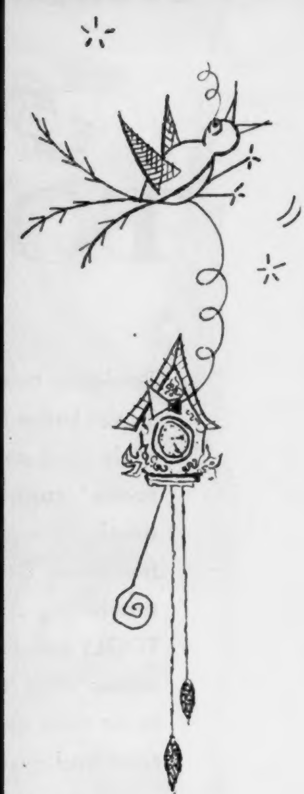
YOUR TURNING-TIME CONCEPTS

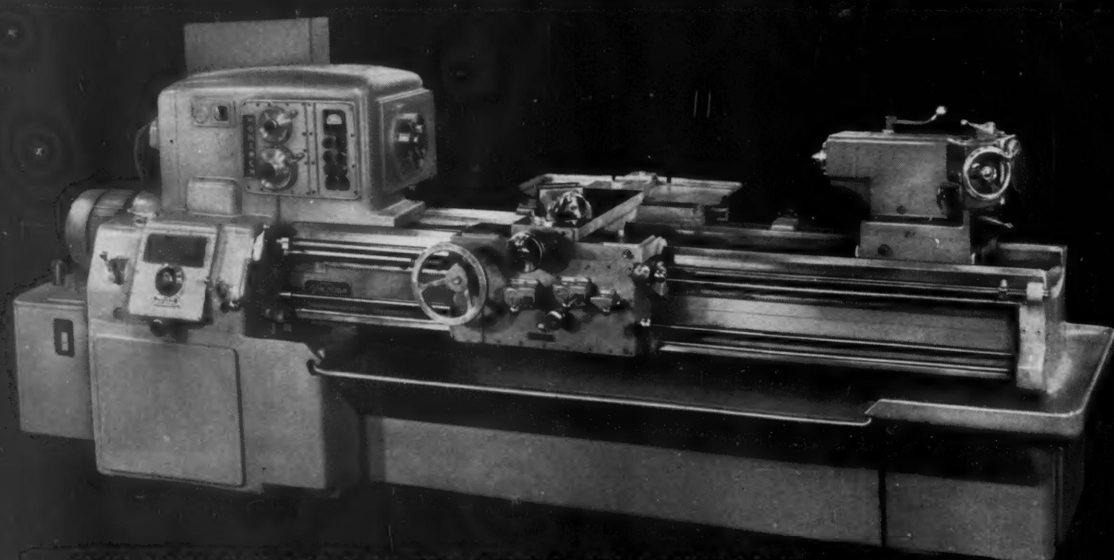
Set it—forget it! That's the story of the Preselector Dyna-Shift. It's the brain Monarch has built into the new Series 62. With it *this* machine will give a greater ratio of metal removing hours to work hours than you ever dreamed possible.

When setting up, merely dial the surface speed wanted and the first diameter to be turned—the Dyna-Shift computes the R.P.M. and makes the shift instantaneously and automatically. *(Time-saver #1).* Then, to maintain this surface speed on successive diameters, set the work diameter selectors. Every speed change thereafter, on *every* piece in the run, takes place automatically with but one fast dial setting and movement of the work start and stop lever. *(Time-saver #2).* What's more, here at last is the lathe with a speed range so wide as to take care of all your needs. Its 20 H.P. drive gives you 36 different spindle speeds in a range from 14 to 1750 R.P.M., a ratio of 1 to 125. *(Time-saver #3).*

Nor are the time-saving features of the Series 62 limited to the Preselector Dyna-Shift headstock. There's four-way power rapid traverse which cuts tool positioning time on the average of 50%. There's the totally enclosed and automatically lubricated gear box and end gearing. There's a completely new two speed tailstock. Add them all up and you get a new lathe concept that means Production with a capital P!

You will want to know all about these and many other features in detail. Send the coupon for the greatest turning news in years!! . . **The Monarch Machine Tool Company, Sidney, Ohio.**



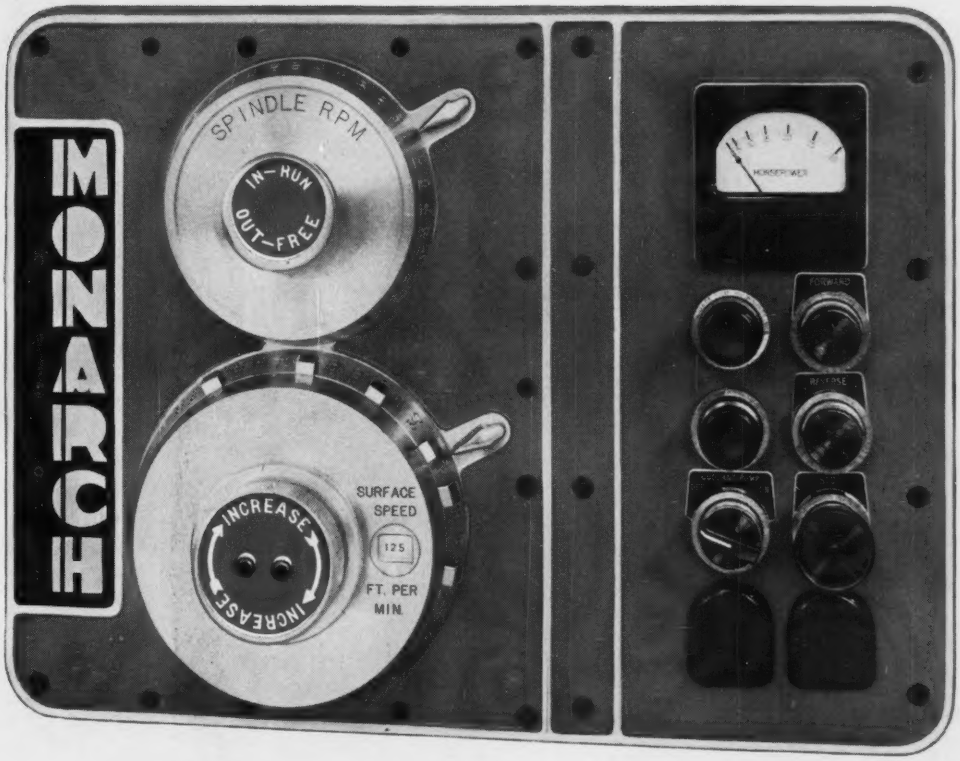


THE NEW MONARCH SERIES 62 PRESELECTOR DYNA-SHIFT LATHE

Models 130 and 1130 (above)—13" swing over cross slide, 20" clearance diameter.
Models 131 and 1131—16" swing over cross slide, 24" clearance diameter.

ARE IN FOR A SHOCK!

See the New Monarch Series 62 Preselector Dyna-Shift -- Unequaled for Speed and Ease



Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER ... TURN TO MONARCH

THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio

Gentlemen:

☐ I am interested in your Series 62 story. Please send me your illustrated Booklet #1501 with complete data.

☐ Please have a Monarch sales engineer call on me.

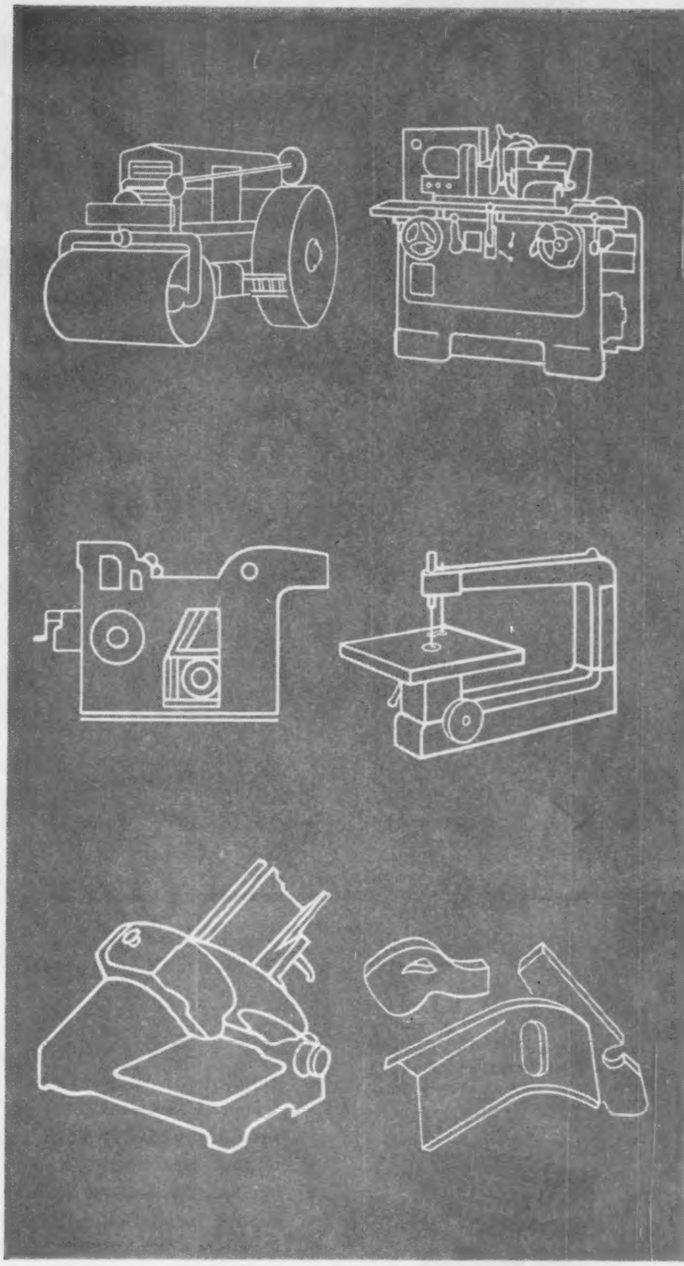
NAME ________ TITLE ________

COMPANY ________

ADDRESS ________

CITY ________ ZONE ________ STATE ________

FILL OUT COUPON—and attach to your business letterhead, please.



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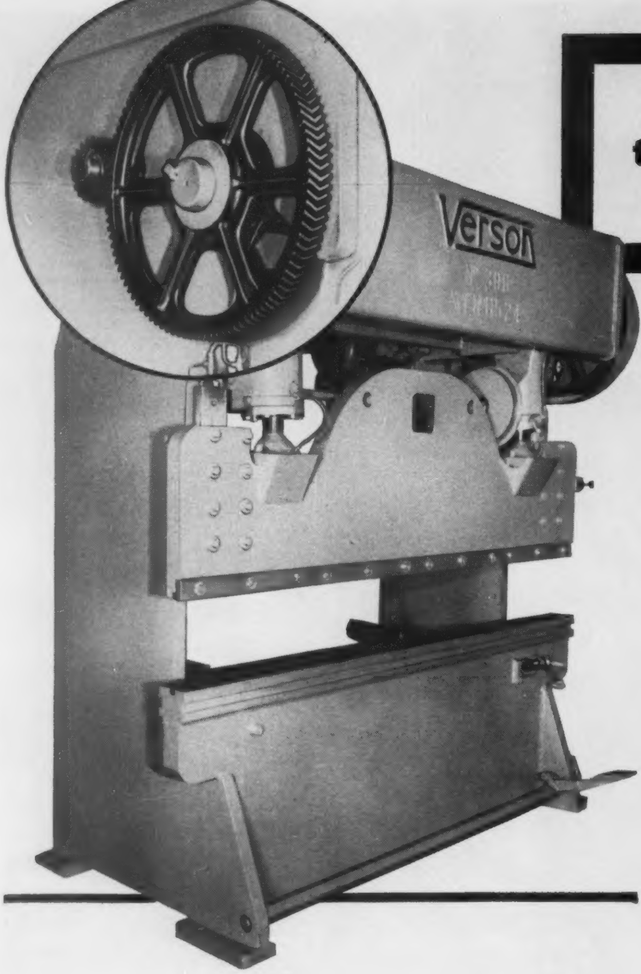

These are the features
that make Verson brakes your best buy

HERRINGBONE DRIVE GEARS
assure long life, smooth, quiet operation with

Verson

PRESS BRAKES

Above is one of the new Verson 300 Series Press Brakes, an exceptional value for medium heavy work. Write for details.

Typical of the advanced design of all Verson machines is the gearing employed in Verson Press Brakes. Drive pinions and gears of all Verson Press Brakes are of the continuous herringbone type. They are produced under strict control in Verson's own ultramodern gear cutting department. Skilled operators using the most modern equipment produce the finest press brake gearing that is commercially available. Before installation, all gears and pinions are matched and checked to operate quietly and smoothly as a pair.

Herringbone gearing is just one of the quality features built into Verson Press Brakes to assure you of the best value. From the thick and deep bed and ram sections to the spring loaded, mechanically actuated shoe type brake, Verson Press Brakes are designed and built to give longer life and better performance in every way.

The Verson Press Brake line is complete—from the smallest to the largest. Whatever your needs it will pay you to bring them to Verson. For specific recommendations, send an outline of your requirements.

CATALOG B-51 gives design details and specifications on Verson Press Brakes. Write for your copy.

A Verson Press for every job from 60 tons up.

Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • SO. LAMAR AT LEDBETTER DRIVE, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES


UNION TWIST DRILL CO.
ATHOL, MASS., U.S.A.

CECO-DROP does more forging per blow... makes more forgings per hour

The piston-lift gravity drop hammer with short stroke control

CHAMBERSBURG

THE HAMMER BUILDERS

CHAMBERSBURG ENGINEERING CO.

Builders of THE IMPACTER
"FORGING IN MID-AIR"

CHAMBERSBURG, PENNSYLVANIA

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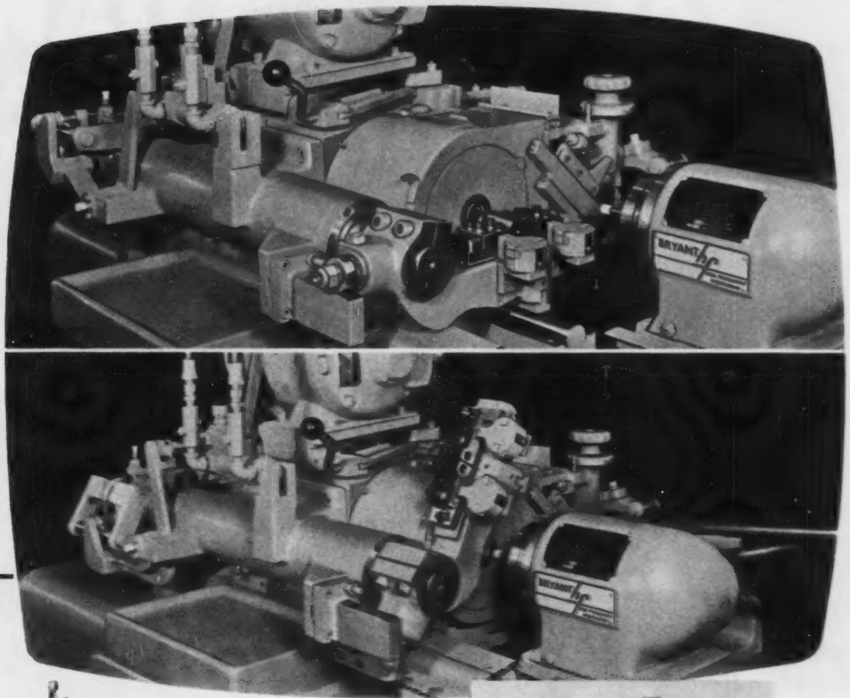
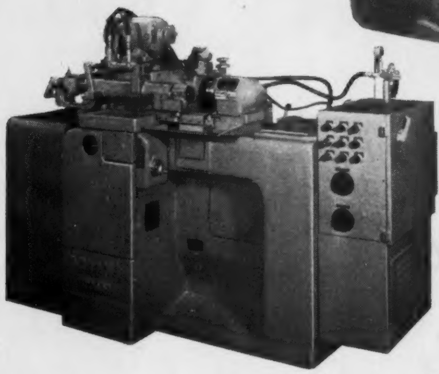
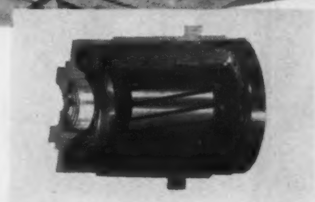
To cut costs and save rehandling-







BRYANT

internal grinder . . . combines boring and grinding operations

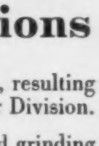
These photos show how a Bryant Internal Grinder eliminates rechucking of workpieces, resulting in increased production and reduced scrap at Bendix Aviation Corporation's Eclipse-Pioneer Division.

Here, a Bryant model 1209-Y speeds up a fast moving production line by performing both boring and grinding operations on synchro motor housings. Single point carbide tools bore two holes and a face simultaneously in each housing. The grinding operation consists of grinding the stator bore. A fine ground finish is necessary to eliminate possible burrs in the stator slots which could cause failures. Bryant precision alignment assures concentricity held well within the required .0003" tolerance for size, roundness and concentricity. This method has resulted in cutting scrap more than 50% over previous methods used.

Fully automatic Bryant grinders featuring automatic loading and sizing can be readily integrated into your automated production lines. Models ideally suited for tool room and small lot work are also available.

Bryant grinders offer you operating economy — at peak production rates. Their adjustable precision alignment ensures maximum accuracy and minimum maintenance — factors that cut cost per piece.

Write for our free Alignment booklet. Ask, too, for a reservation card for our new sound color movie "Alignment for Better Internal Grinding" — free showings arranged for engineering groups.



BRYANT chucking grinder co.

SPRINGFIELD, VERMONT, U.S.A.

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

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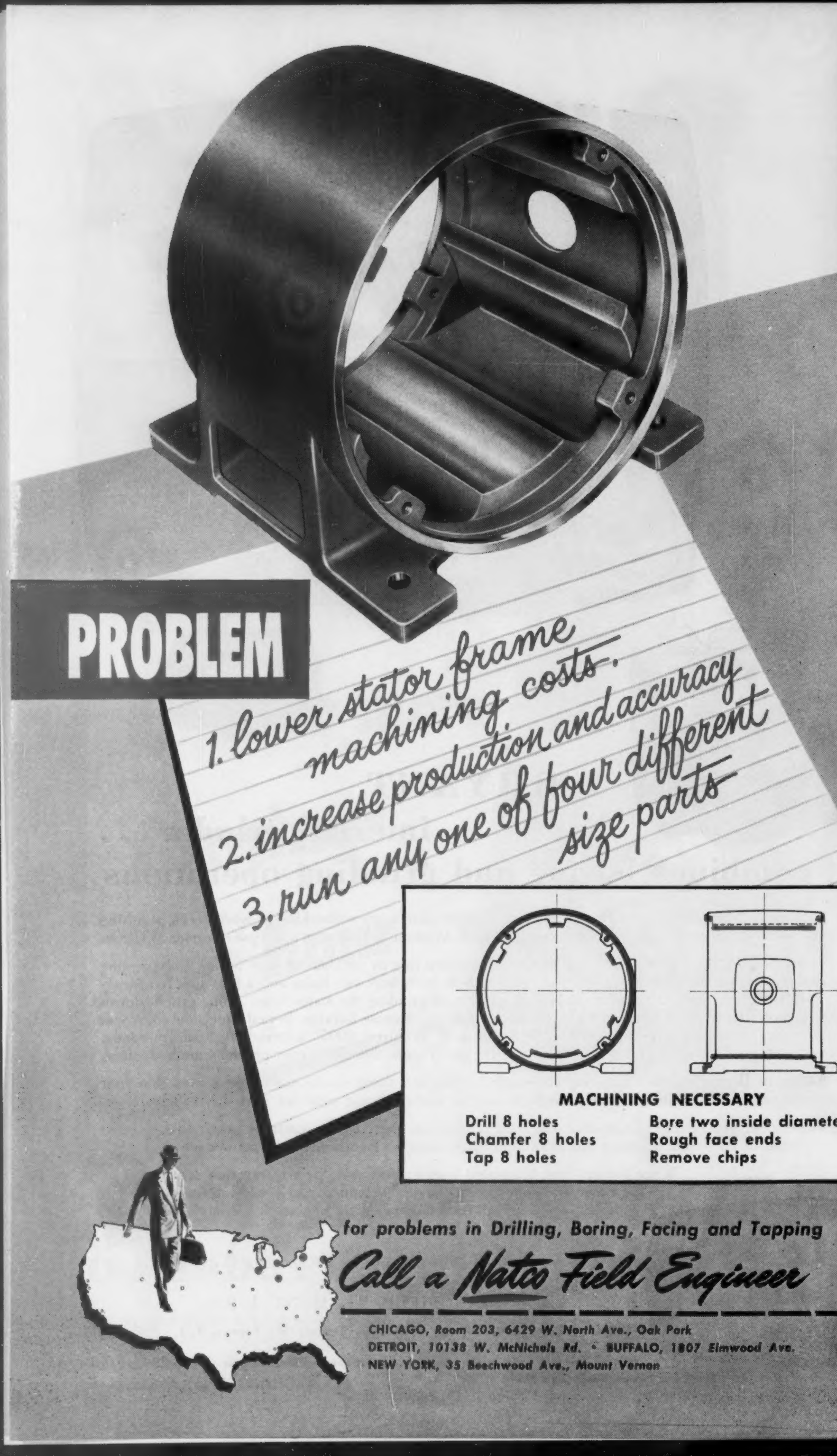
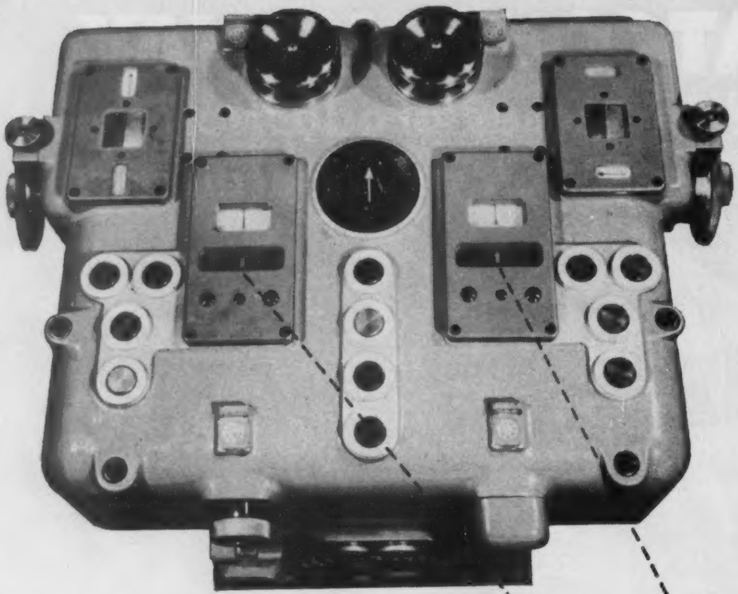

PROBLEM
1. lower stator frame machining costs.
2. increase production and accuracy
3. run any one of four different size parts
MACHINING NECESSARY
Drill 8 holes
Chamfer 8 holes
Tap 8 holes
Bore two inside diameters
Rough face ends
Remove chips
for problems in Drilling, Boring, Facing and Tapping
Call a Natco Field Engineer
CHICAGO, Room 203, 6429 W. North Ave., Oak Park
DETROIT, 10138 W. McNichols Rd. • BUFFALO, 1807 Elmwood Ave.
NEW YORK, 35 Beechwood Ave., Mount Vernon



most revolutionary advance in precision hole location since the jig borer—

LINDNER *preselective* AUTOPOSITIONER

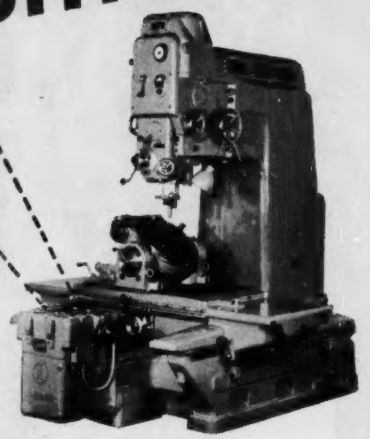
Now operator can speed up initial table settings—preselect exact table position for next hole while one boring operation is in progress—do it consecutively, accurately for each hole in workpiece.

You soon see the difference in faster *initial* table settings, guaranteed accurate within .00015". In increased jig boring production, too—with the preselective Autopositioner available only on the Lindner LB15 Optical Jig Borer.

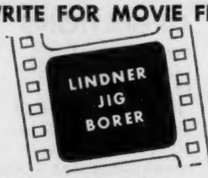
Non-productive time is practically eliminated. As one hole is completed, a push button unlocks the 44" x 24" table for rapid traverse (up to 40" per min.) movement in both directions to next preselected position. A few seconds for fine adjustment, then table is automatically locked in position and boring operation begins. Optical projection system permits exact centering—minimizes operator error and fatigue.

Direct-reading micro-optical measuring system is permanently free of wear... *only a light beam touches it.* No lead screws—therefore no back lash. Hole location may be approached from any position from either direction. Speeds and feeds are infinitely variable—spindle speeds range 25-1900 r.p.m.; milling feeds 1"-3" with power up-feed of spindle for fine finishing of bored holes.

Add to this, rugged single column construction for heavy roughing without affecting fine precision performance, and unusually deep throat for large, bulky workpieces—and you'll see why so many important toolrooms which measure precision in extremely close limits, now use one or more Lindners. Write for complete specifications on LB15 and smaller LB14 models.



SEE AUTOPOSITIONER AT WORK
WRITE FOR MOVIE FILM



This 20 minute film takes you through design, manufacture and operation of the Lindner Jig Borer—demonstrates how Autopositioner combined with unique micro-optical measuring system makes the Lindner today's most advanced jig borer. It answers many of your questions. Lindner users will fill in the rest.

KO CO., INC. INDUSTRIAL IMPORTERS

KURT ORBAN

COMPANY, INC.
34 Exchange Place, Jersey City, N. J.

Toolroom and production machine tools for precision milling, boring, turning, drilling, grinding, hob grinding, gear testing.

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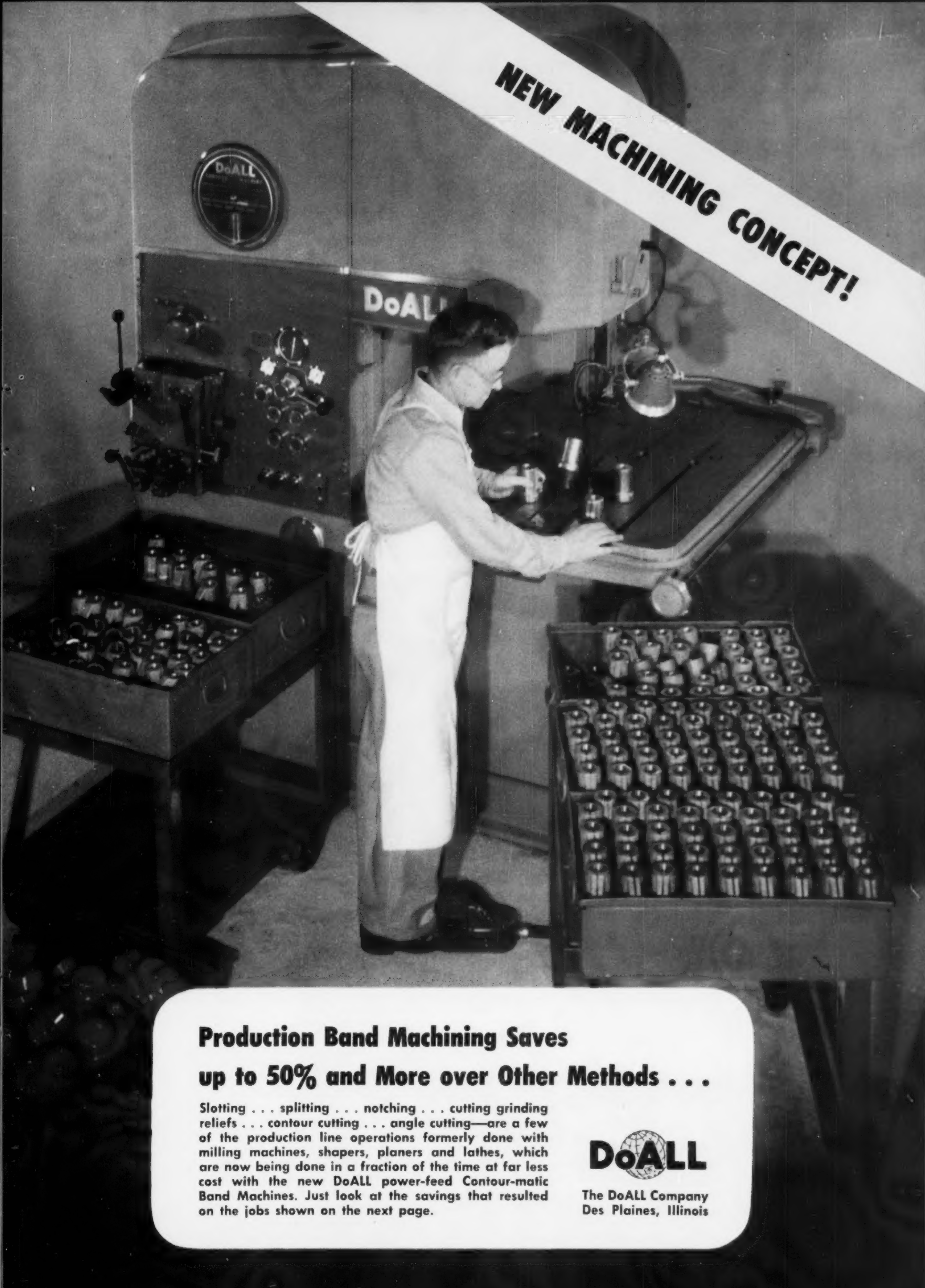
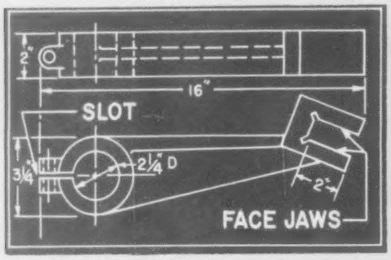
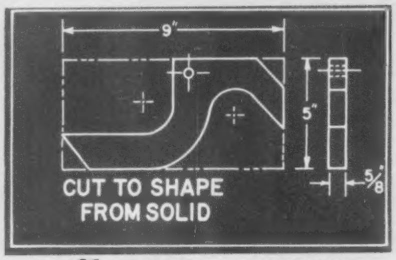

NEW MACHINING CONCEPT!
DoALL
DoALL
Production Band Machining Saves
up to 50% and More over Other Methods . . .
Slotting . . . splitting . . . notching . . . cutting grinding reliefs . . . contour cutting . . . angle cutting—are a few of the production line operations formerly done with milling machines, shapers, planers and lathes, which are now being done in a fraction of the time at far less cost with the new DoALL power-feed Contour-matic Band Machines. Just look at the savings that resulted on the jobs shown on the next page.
DoALL
The DoALL Company
Des Plaines, Illinois

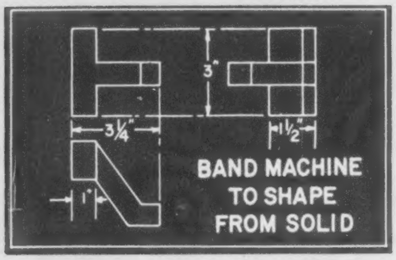
Typical Jobs Done Faster at Lower Cost by DoALL Production Band Machining!



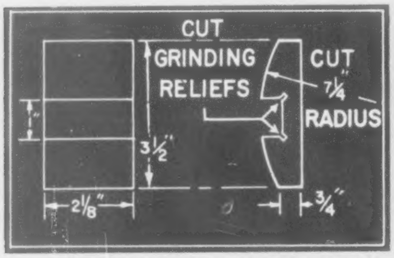
53% TIME SAVING
in cutting .100" slot and facing two 2" x 2" cast jaws. 150 pieces formerly milled in 13.15 hours; now band machined in 6.25 hours.



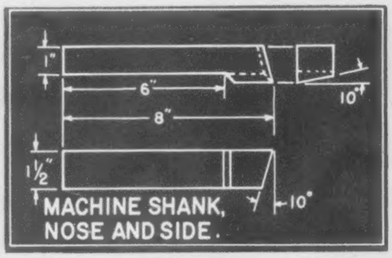
19% TIME SAVING
cutting 175 levers from plate. Formerly torch cut and ground in 29.22 hours; now band machined in 23.62 hours with no grinding required.



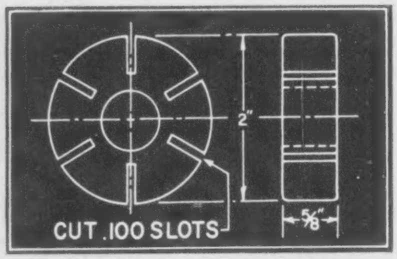
46.28 HOURS SAVED
cutting mounting bracket from solid. 75 pieces formerly shaped in 60.0 hours; now band machined in 13.72 hours—77% time saving.



56% TIME SAVING
in machining radius and grinding reliefs. 50 pieces formerly milled in 3.10 hours; now band machined in 1.35 hours.



58 HOURS SAVED
machining tool shank nose and side. 500 pieces formerly produced in 99.5 hours; now band machined in 41.5 hours.



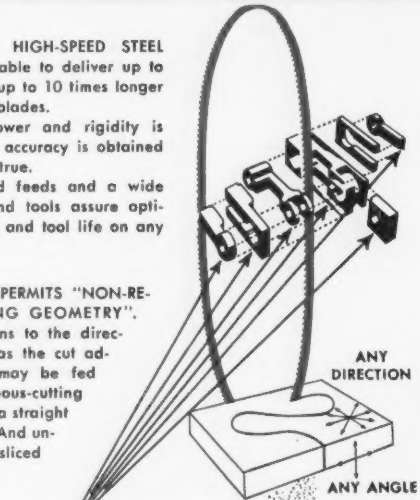
48 HOURS SAVED
cutting .100 x .4375 slots in rotors. 2000 formerly milled in 66.6 hours; now band machined in 18.6 hours—72% less time.

NEW DoALL DEMON HIGH-SPEED STEEL SAW BANDS are available to deliver up to 6 times faster cutting, up to 10 times longer life than carbon steel blades.

Greater machine power and rigidity is now provided. Highest accuracy is obtained—cuts are square and true.

Variable speeds and feeds and a wide range of different band tools assure optimum production, finish and tool life on any machinable material.

THE BAND MACHINE PERMITS "NON-RESTRICTED MACHINING GEOMETRY". There are no restrictions to the direction of cutting action as the cut advances. Hence, work may be fed to the narrow, continuous-cutting band tool along either a straight or "contoured" course. And unwanted material is "sliced off" in whole sections.



New DoALL Contour-matic band machines have opened up an entirely new machining concept. An automatic hydraulic power feed table carries the work into the thin continuous-cutting band tool. Integral recirculating coolant system and air jet promote high cutting rates and long tool life. Cutting forces hold the work down to the table—only the simplest fixtures are required. Tooling cost is far less than for other machine tools. Setup and floor to floor time is greatly reduced.

Faster cutting... lower tooling cost... lower capital investment (a DoALL power feed band machine costs but ⅕ to ½ as much as production milling machines, shapers or planers) — these are the money-saving advantages of DoALL *production band machining*. For complete details call your local DoALL Store—see classified listing in your phone book—or write THE DoALL COMPANY.

NEW FILM "Production Band Machining" now available showing operation of this new machining concept.

ASK FOR FREE DEMONSTRATION at your plant. There is absolutely no obligation—a DoALL Demonstration Unit will pull up in your "back yard" and show you production band machining in action.

EDUCATIONAL STUDY WALL CHARTS
Economic Principles
$1.00 each postpaid
Lower quantity prices.

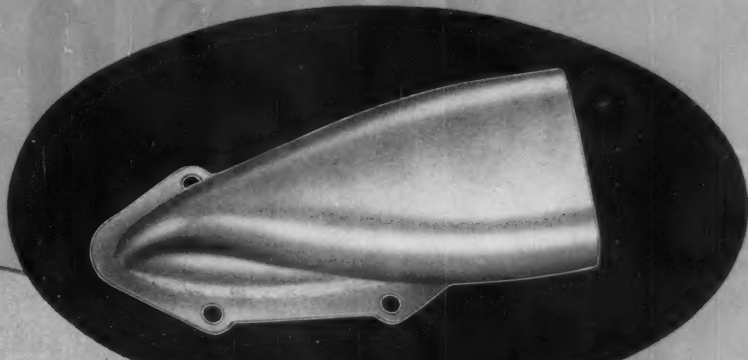
Friendly DoALL Stores . . . (in 40 cities)

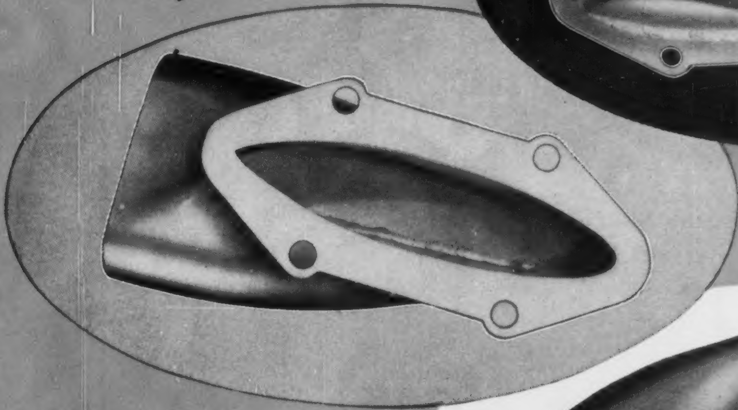
Personalized Service... Complete Stocks... Local Delivery

the answer to this tough one . . .

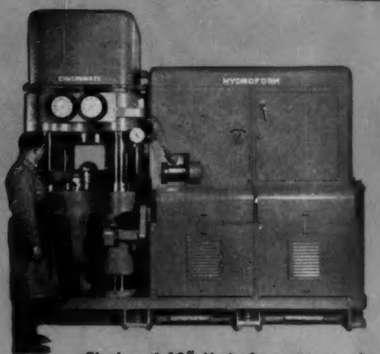
THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

SEE HYDROFORMING BOOTH No. [illegible]





Two views of a jet engine component produced from the Hydroformed blank shown in the photo below. Material is 0.048″ Chromaloy. Part length is 5¾″.



Cincinnati 12″ Hydroform. Also made in 8″, 19″, 23″, 26″, and 32″ sizes.

was Hydroforming

The manufacturer who contracted to supply this jet engine component certainly got the job off to a good start. It was well planned throughout. The finished shape was to be obtained by drawing a blank of 0.048″ Chromaloy to the required contours so that by cutting the part lengthwise, a right-hand and left-hand section would be produced. The sections, plus a stamped flange, were to be assembled by welding.

The shape of the punch was accurately developed and draw press tools were made. Then the trouble started. The available equipment would not form a satisfactory part. And time was getting short.

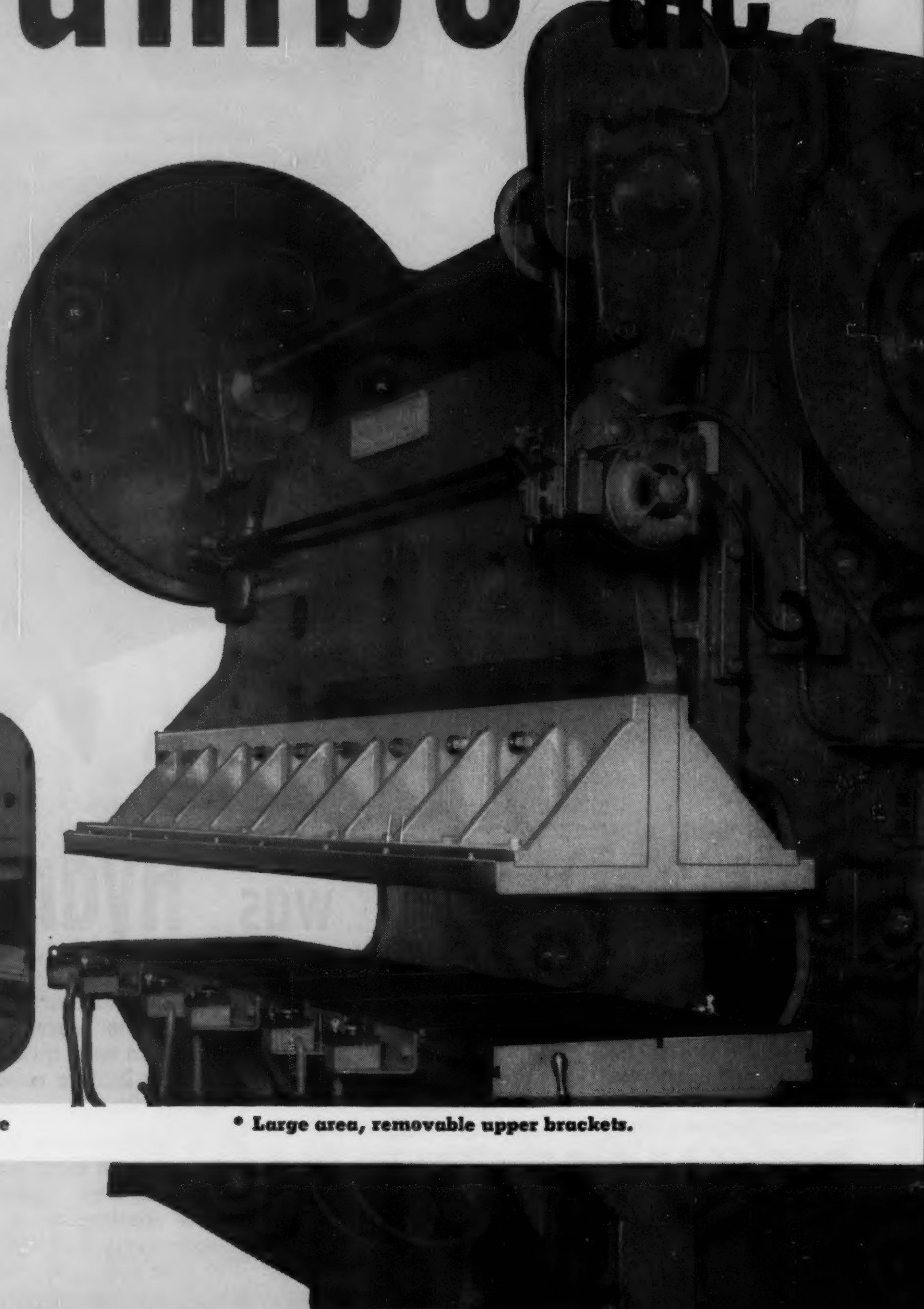
So the manufacturer shipped the punch and material to the nearest Cincinnati 12″ Hydroform. The blanks were quickly drawn to shape—and the jet engine builder received the required number of parts on time.

Manufacturers who have invested in Hydroforming have been rapidly repaid in shortened part development time, in greatly reduced tool expense, in the elimination of operations, in part quality improvement. Let a Cincinnati Milling field engineer give you complete details. For a description of the Hydroforming process and specifications of the six machine sizes, write for Bulletin M-1759-3.

CINCINNATI **Hydroform**

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

Jumbo die



• Short, special purpose, removable upper brackets.

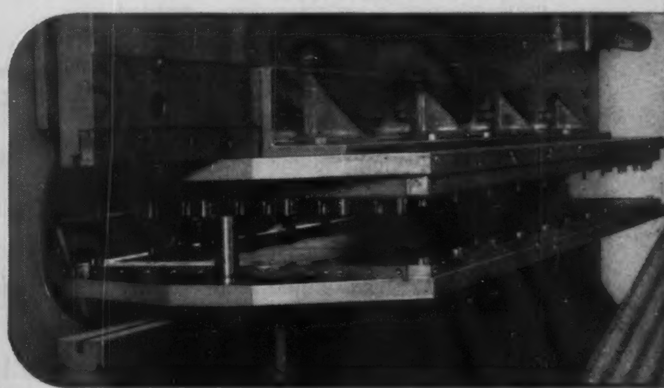
• Large area, removable upper brackets.

areas...

on Cincinnati Press Brakes

More and more jobs are being done on versatile Cincinnati Press Brakes. Removable or fixed brackets with large die areas permit many jobs to be done both in the Press Brake and Press fields. When dual purpose performance is required removable brackets are used—for Press work only, fixed brackets are furnished. Brackets are designed to sizes desired.

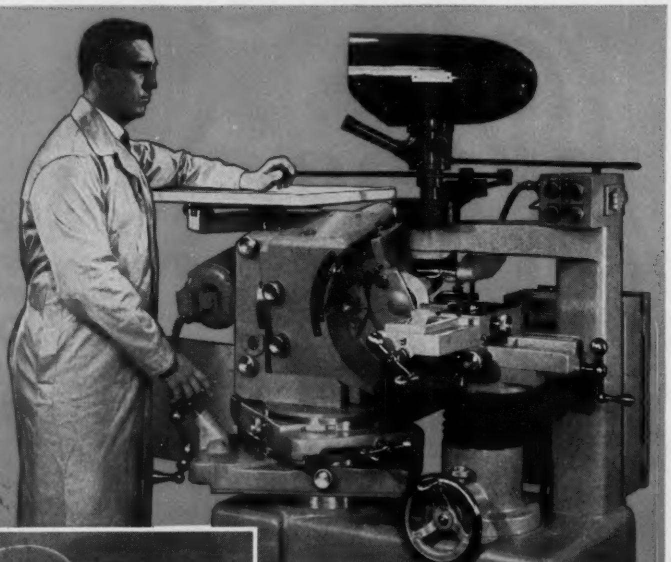
• *Large area, permanent wide bed and ram for press work.*

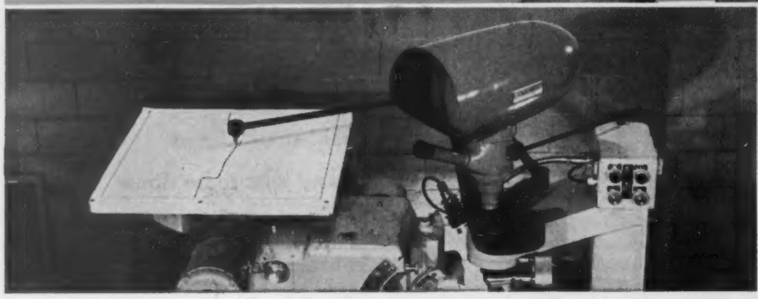


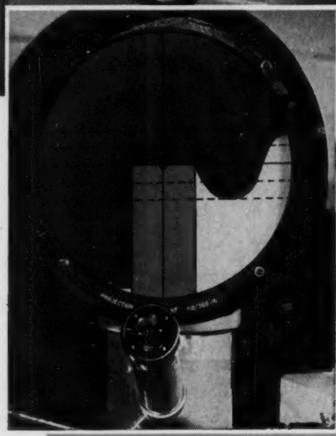
• *Large area, removable upper and lower brackets.*

Investigate! **Our Engineering Department will be glad to advise you on the profit and production possibilities in your shop. Write for Catalog B-4.**

Grind High Precision Profiles Directly from the Drawing *with* SHEFFIELD'S MICRO-FORM GRINDER

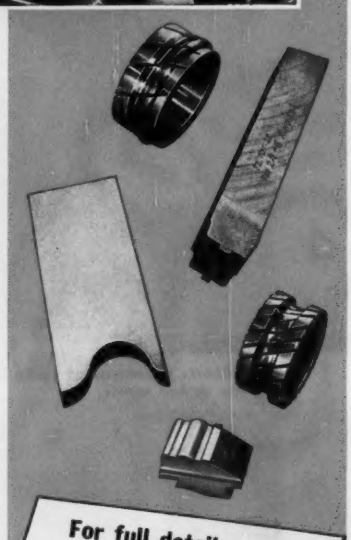






FEATURES

- Grinds both flat and circular profiles
- No restrictions on profile intricacy
- No templates needed
- Perfect toolroom accuracy
- Saves up to 75% on profile work
- Final accuracy checked while work is still on the grinder
- Accuracy not affected by wheel wear
- No special wheel dressing required as wheel can be set at any angle—fewer wheels are needed
- Diamond impregnated wheels used in grinding carbides last longer—no waste as no special dressing is required
- Multiple work parts ground simultaneously
- Grinds any material including carbides
- Controlled by 50:1 pantograph and 30 power scope and viewing screen



The Sheffield Corporation
Dayton 1, Ohio, U.S.A.

See us at the
Machine Tool Show, Booth 1305

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

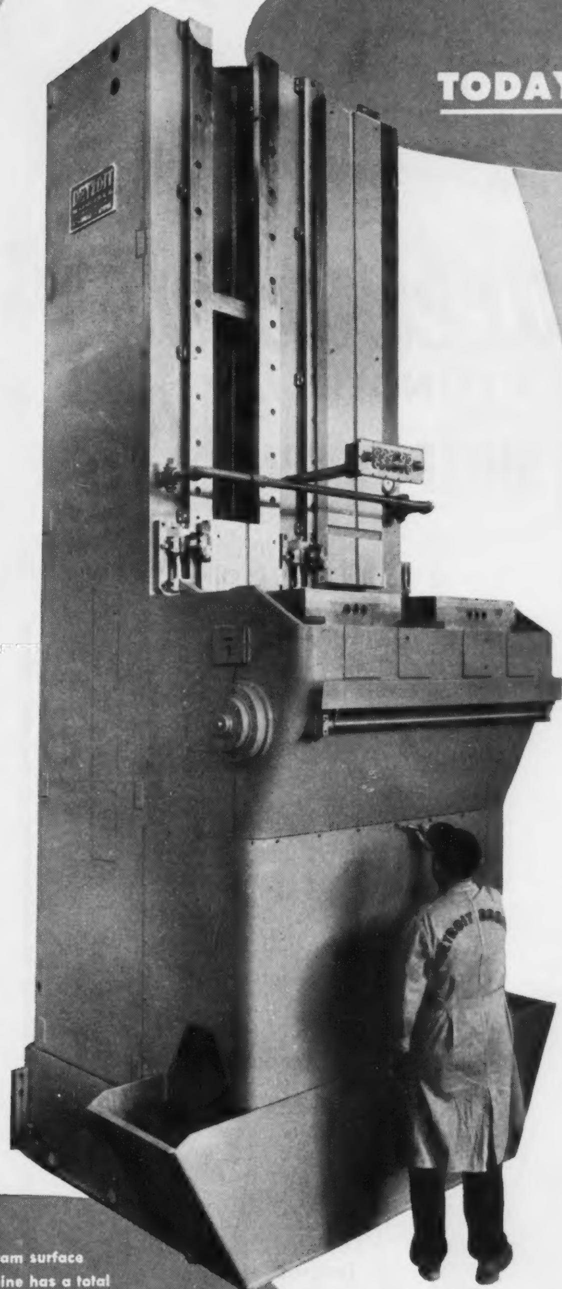
For full details and specifications ask your Sheffield representative for Bulletin MFG-122-51 or write us direct.

7144

For more information on products advertised, use Inquiry Card, page 253

Detroit BROACHING MACHINES

BUILT FOR TODAY'S *and Tomorrow's* BROACHING NEEDS



This huge dual ram surface broaching machine has a total tolerance of .0005" run out throughout its 100" stroke. Machine was designed and built to lick a particularly tough broaching problem . . . furnished with complete carbide tooling.

Detroit Broach is building the finest in broaching machines . . . machines that are designed to make easy the broaching of today's "miracle metals." All of the experience and knowledge obtained from many years as a pioneer and leader in the design and manufacture of broaching tools has gone into the development of these "years ahead" machines.

Detroit broaching machines are sturdy and rugged in construction . . . designed to withstand high broaching speeds in the toughest of metals. The complete line is available in a wide range of sizes with strokes from 6" to 100". Many advanced engineering features are incorporated, such as Oilgear hydraulic equipment, automatically adjusted shuttle tables and precision slides.

COMPLETE BROACH SERVICE

For many years specialists in broaches and broach tooling exclusively, Detroit has unmatched experience and facilities to offer for broach tooling also. Thus, you can place complete responsibility for your entire broach needs in the hands of one competent organization. The result is consistently greater production economy, efficiency and precision.

Detroit Broach COMPANY

ROCHESTER, MICHIGAN

OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

First in performance for automatic muscle jobs like these...

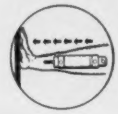
T-J

Spacemaker

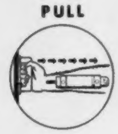
CYLINDERS

OFF SHELF DELIVERY

PUSH



PULL



LIFT

Raise
Lock
Brake
Press
Spin
Turn
Grind
Weld
Lower
Squeeze
Bend
Coin
Saw
Tap
Index
Braze
Open
Time
Blank
Cut
Broach
Drill
Sequence
Close
Snub
Form
Pierce
Feed
Mill
Convey
etc.

- **OIL pressure to 750—AIR to 200 P.S.I.**
- **New Compact Design . . . Saves up to 40% Space**
- **Proven Performance . . . with Extra High Safety Factor**
- **Super Cushion Flexible Seals for Air . . . New Self-Aligning Adjustable Oil Cushion**
- **Hard Chrome Plated Bodies and Piston Rods**
- **The Only Cylinders with all the Extras as Standard**

T-J Spacemaker Cylinders get first call for an ever-widening range of power movement jobs in industry today—because they're so advanced in design . . . so efficient and dependable in performance. Wide selection of styles and capacities. Check your needs now! Send for bulletin SM-454-2. The Tomkins-Johnson Co. Jackson, Mich.

T-J **TOMKINS-JOHNSON**

RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

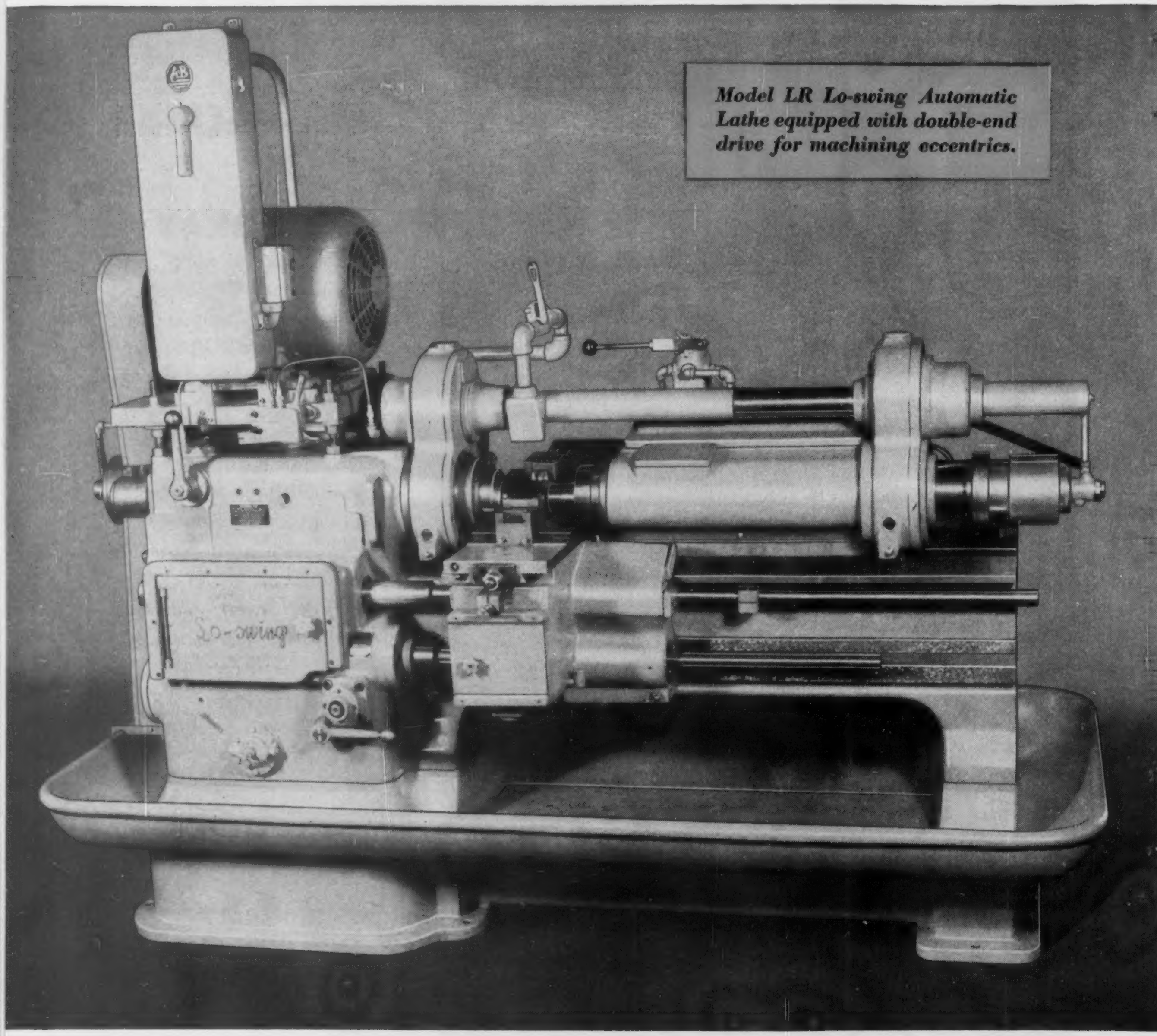
Member of the National Fluid Power Association

For more information on products advertised, use Inquiry Card, page 253


whether it's a . . . PLANER
or a BORING MACHINE
. . . it's still a GRAY
with the matchless workmanship, outstanding engineering and ease of operation that have always made a GRAY the outstanding favorite for as long as you can remember.
Non-metallic ways, column cross travel, up to 100 HP spindle motor, and controls that encourage proper operation will prove to you that . . .
Quality doesn't cost . . . it pays.
FREE—Boring Mill Bulletin.
The G.A. GRAY Company
planers • milling planers
planer type milling machines
horizontal boring machines
CINCINNATI 7, OHIO, U. S. A.
SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

MACHINE OF

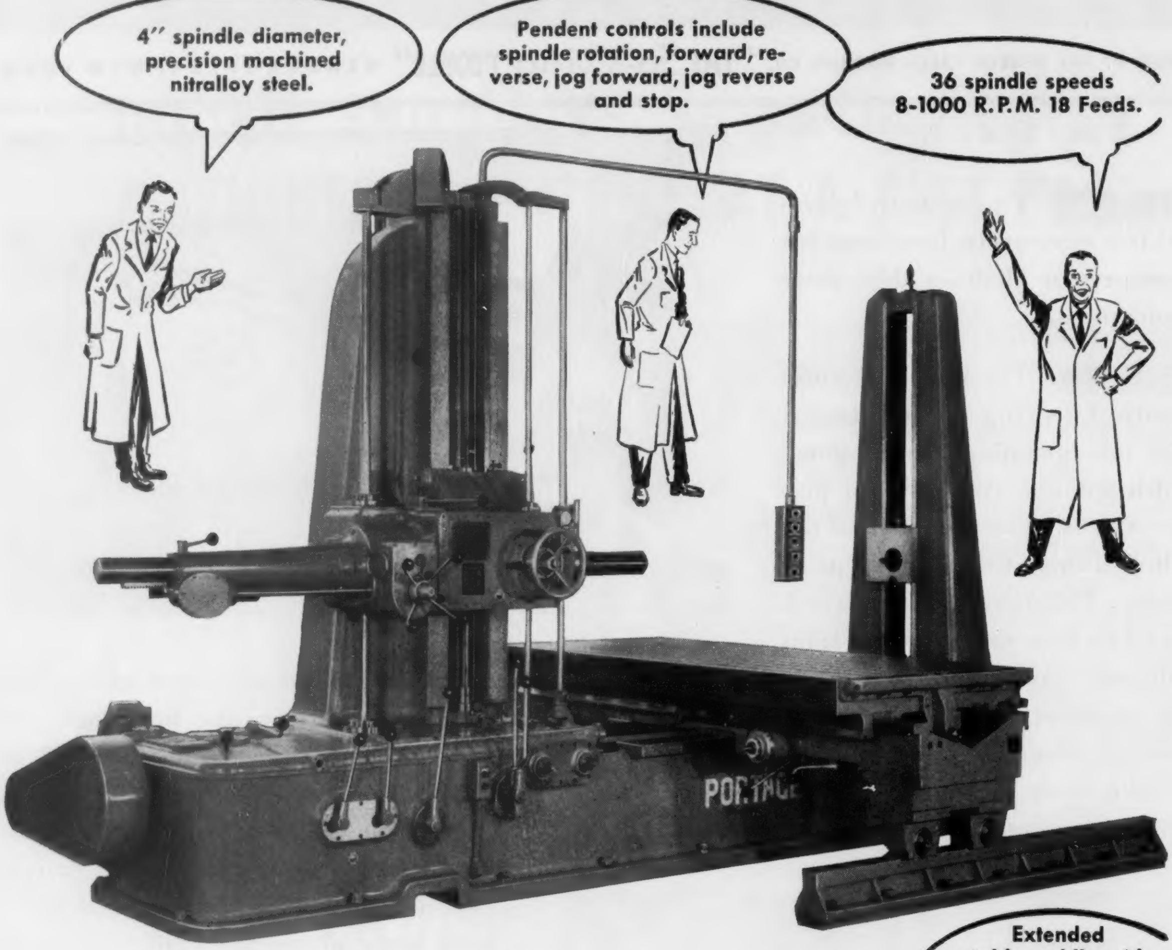
DOUBLE END DRIVE *Lo-swing* LATHE MACHINES ECCENTRICS AT A FAST PACE

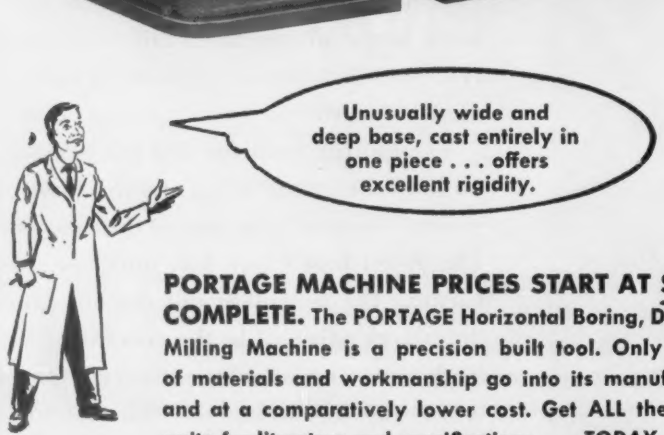


Model LR Lo-swing Automatic Lathe equipped with double-end drive for machining eccentrics.

PRODUCTION COSTS

CHECK THESE *Features...*





PORTAGE MACHINE PRICES START AT $31,358 COMPLETE. The PORTAGE Horizontal Boring, Drilling and Milling Machine is a precision built tool. Only the finest of materials and workmanship go into its manufacture . . . and at a comparatively lower cost. Get ALL the facts . . . write for literature and specifications . . . *TODAY.*

PORTAGE
METAL WORKING SPECIALISTS

THE PORTAGE MACHINE CO.

1036 Sweitzer Avenue • Akron 11, Ohio

Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

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PIONEERS OF H.S.S. BROACHING

COLONIAL

BROACH CO. DETROIT 13

UNIFIED BROACHING is the key to successful broaching

For more information on products advertised, use Inquiry Card, page 253

Drive with Printed Control Circuits

NOW! GET RELIABLE, SMOOTH, ADJUSTABLE SPEED FOR MACHINE TOOLS IN A SIMPLIFIED, LOW-PRICED DESIGN

Designed for quality performance, reliable operation, easy maintenance, and at a new low price, a new and simplified line of general purpose Thy-mo-trol Drives has been developed by General Electric. These drives represent a new and far-reaching step in electronic adjustable speed.

An approximate 20% price reduction under the line it replaces is possible because G-E has successfully simplified the entire control system and has adapted printed control circuits into the Thy-mo-trol panels. New Thy-mo-trol design allows a substantial reduction in *weight, size, circuit complexity, wiring, maintenance costs and installation cost.* The new design is now available in two ratings: ¾ to 1 hp and 1½ to 3 hp—making your choice of an adjustable speed drive to meet specific needs that much easier.

Operating directly from a-c power, the new standard Thy-mo-trol Drive includes an electronic control panel, a d-c motor, and a push-button station. No anode transformer is necessary if operated on 440 volts, 50 or 60 cycle, single phase power. Separately mounted auto-transformers are supplied as a standard feature for voltages other than 440.

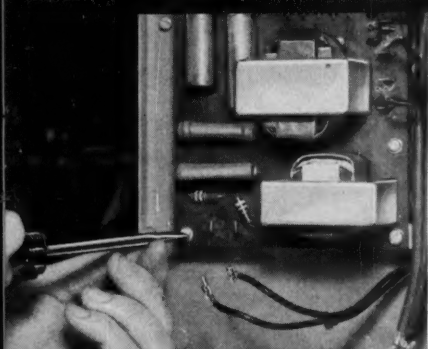
The new drive is rated at constant torque over the entire speed range. Speed range is 8 to 1 for continuous duty with higher ranges possible for special applications. Optional modifications include jogging, reversing, tachometer feedback, reactor loop control, and external current limit adjustment.

For more information on this outstanding new adjustable speed drive, contact your nearest G-E Apparatus Sales Office or write for Bulletin GEA-6234, General Electric Company, Section 791-1, Schenectady 5, New York.

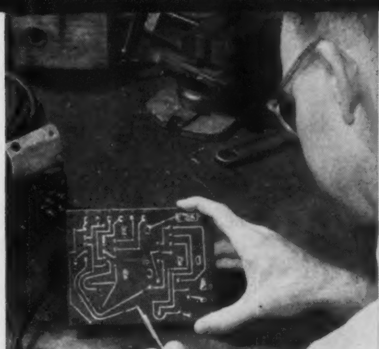
Progress Is Our Most Important Product

GENERAL ELECTRIC

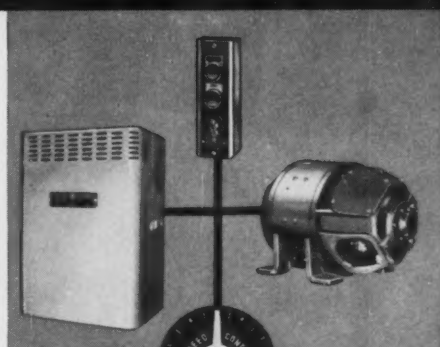
**Registered Trade-mark of General Electric Company*



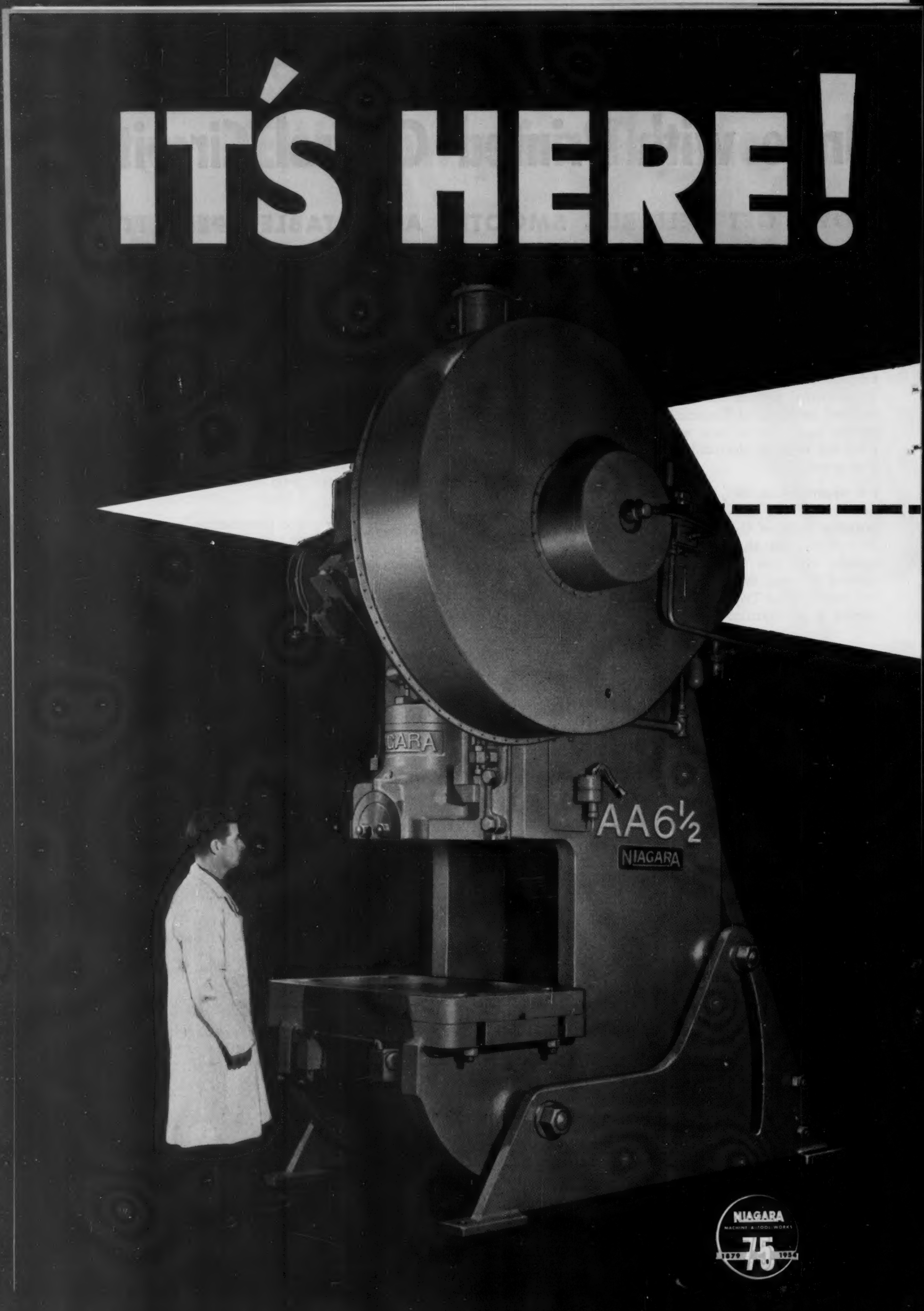
Easily attached or removed. Only a screwdriver is needed. Plugs and terminals are numbered for easier service.



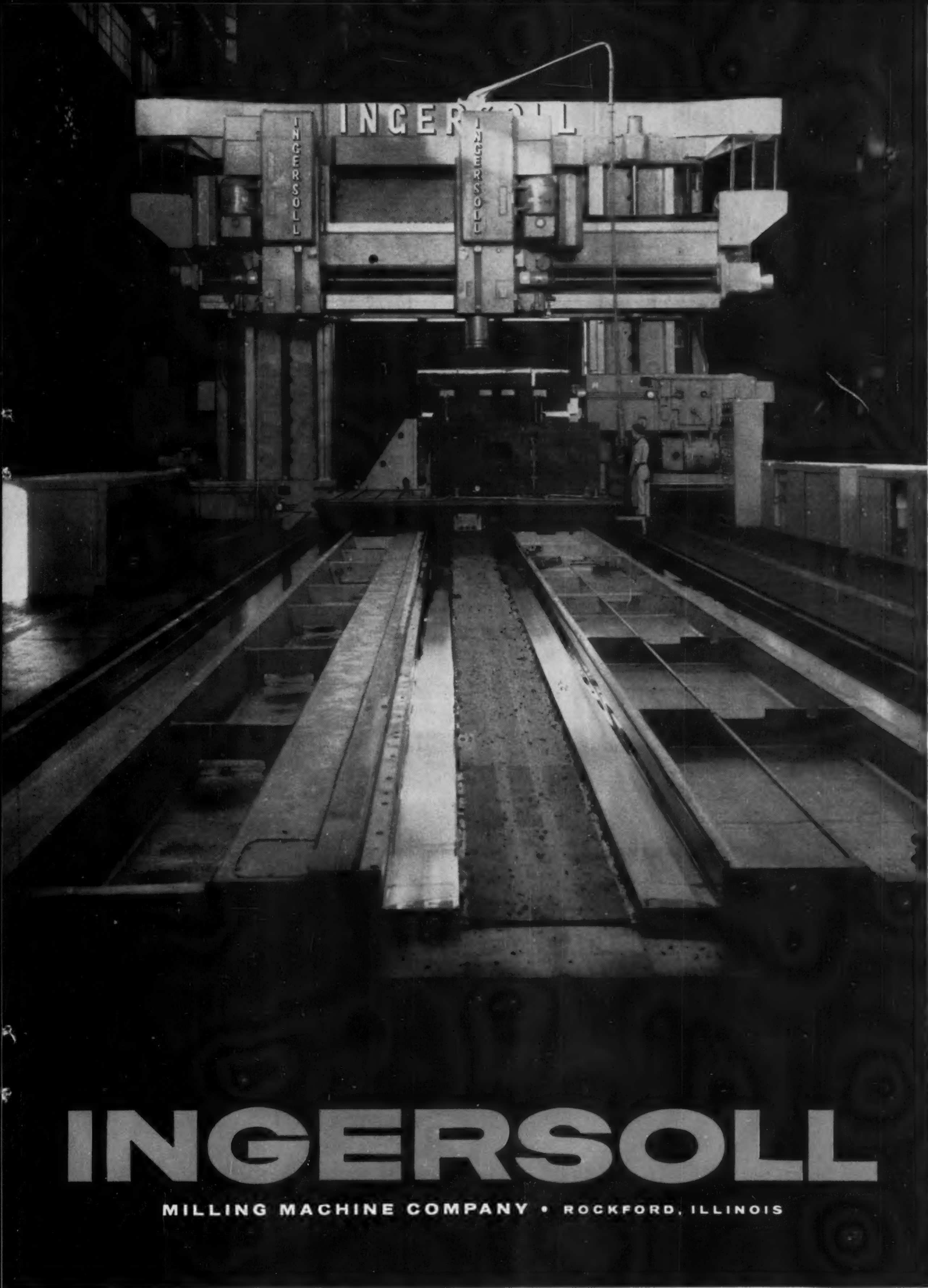
Simplified repair. Component replacement is fast and easy—a simple bench operation. No need to discard entire unit.



Three basic units. DC motor, pushbutton station, and panel containing tubes and "brain" make up new Thy-mo-trol Drive.


IT'S HERE!
AA 6½
NIAGARA
NIAGARA
MACHINE & TOOL WORKS
1879 75 1954

For more information on products advertised, use Inquiry Card, page 253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MILLING MACHINE COMPANY • ROCKFORD, ILLINOIS

GREENLEE

special-purpose machines for profitable mass production

THEY SAVE WORK...THEY SAVE MONEY

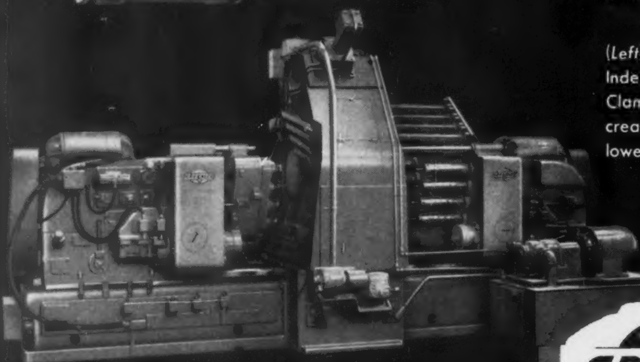
Master brake cylinder machined on above Greenlee Special Machine.

If you are being outdistanced in today's swift race for production...faced with narrowing profit margins...it will pay to investigate Greenlee Special Machines. Savings effected on drilling, reaming, boring, counterboring and tapping operations will quickly amortize your invested dollars.

Wheel cylinder machined on Greenlee Special Machine shown below.

(Above) Greenlee Horizontal Indexing Machine designed for processing master brake cylinders has proved itself with raised quality and lowered costs.

(Left) Greenlee Two-Way Horizontal Indexing Machine equipped with Power Clamping and Automatic Unloading increased previous production rates and lowered costs.

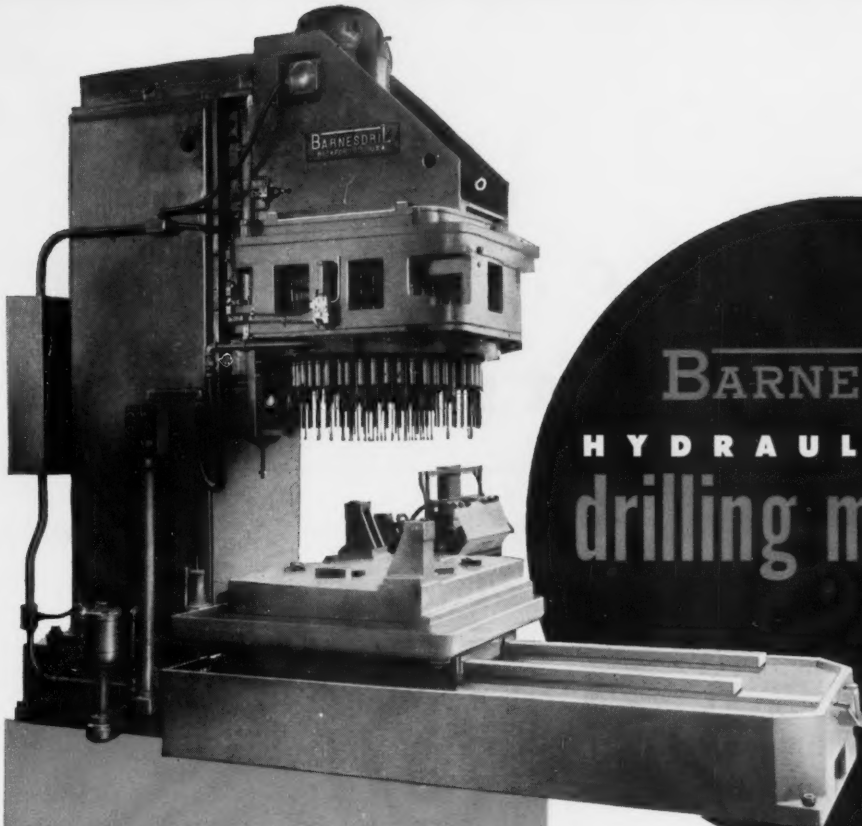


WRITE FOR COMPLETE INFORMATION

PRODUCTION MACHINERY GREENLEE

GREENLEE BROS. & CO.
1865 MASON AVENUE
ROCKFORD, ILLINOIS

CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.



BARNESDRIL

HYDRAULIC FEED

drilling machines

with new features for less downtime in tool changes, easy service accessibility

- **DIRECT MOTOR DRIVE**
  — increases efficiency
  — eliminates linkage.
- **AMPLE STROKE FOR CLEARANCE AND EASY TOOL CHANGE**
  — all tools out in the open.
- **HYDRAULIC CYLINDER SERVICEABLE Without Dismantiling Unit.**
- **ALL VALVES FLANGE-MOUNTED FOR MAXIMUM SERVICE EASE**
  — minimum downtime for servicing.
- **HYDRAULIC SYSTEM MANIFOLD — ARRANGED**
  — eliminates piping and possibility of leakage.

THE MACHINE TOOL SHOW

VISIT Booth No. 818

BARNESDRIL Hydraulic-Feed Drilling Machines provide high speed multiple spindle drilling for a wide range of work on a high output, low cost basis. With new design features, these machines can be kept in continuous operation through change-over to suit small-lot runs. Hydraulic feed and cycle minimize production time to produce minimum cost per piece. For your best investment in drilling equipment, see these machines before you buy.

HOLE BARNESDRIL FINISHING

BARNES DRILL CO.

820 CHESTNUT STREET · ROCKFORD, ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

Hendey NO. 2E LATHE WITH ELECTRONIC

simplifies lathe operation . . .

OPERATOR EFFORT IS REDUCED TO A MINIMUM
MACHINING EFFICIENCY IS INCREASED
16-7/16" SWING OVER WAYS
COSTS ARE CUT AT EVERY TURN

Hendey electronic control of spindle speeds on No. 2E Precision Lathes is effortless with this convenient fingertip selector. It affords a quieter, more efficient drive, with closer control over speeds than is possible with other types, especially at the slower rates. Speeds are adjusted smoothly, either pre-set or while cutting, through the full range up to 1500 r.p.m. to give the most efficient cutting rate for the particular type of cut. Operating efficiency is further stepped-up by single-lever control of start, stop and reverse. Dynamic braking allows smooth and rapid changing from forward to reverse rotation of the spindle.

Additional Hendey quality features make this general purpose lathe a machine you should see before you buy any lathe . . . especially if you want maximum operating efficiency, work accuracy and reduced cost on turning operations.

See It In Action! Booth No. 221

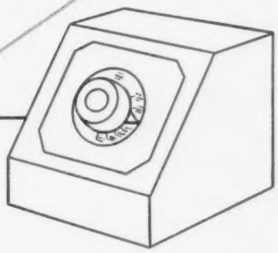
THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

TOPS IN ACCURACY . . . HENDEY PRECISION-BUILT

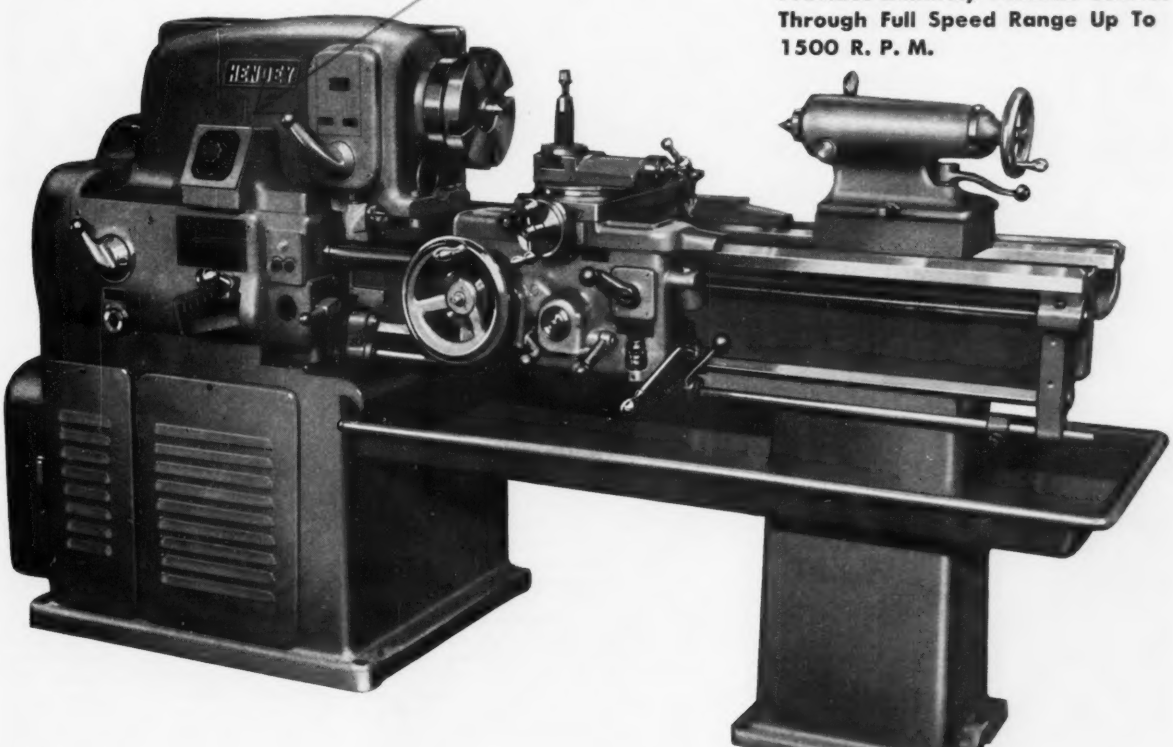
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

SPEED SELECTOR

. . cuts production time



**Instantaneous Speed Selection . . .
. . . Pre-Set or While Cutting . . .
Provides Infinitely Variable Control
Through Full Speed Range Up To
1500 R. P. M.**



MACHINE TOOLS *Hendey* **machine division**

BARBER-COLMAN COMPANY

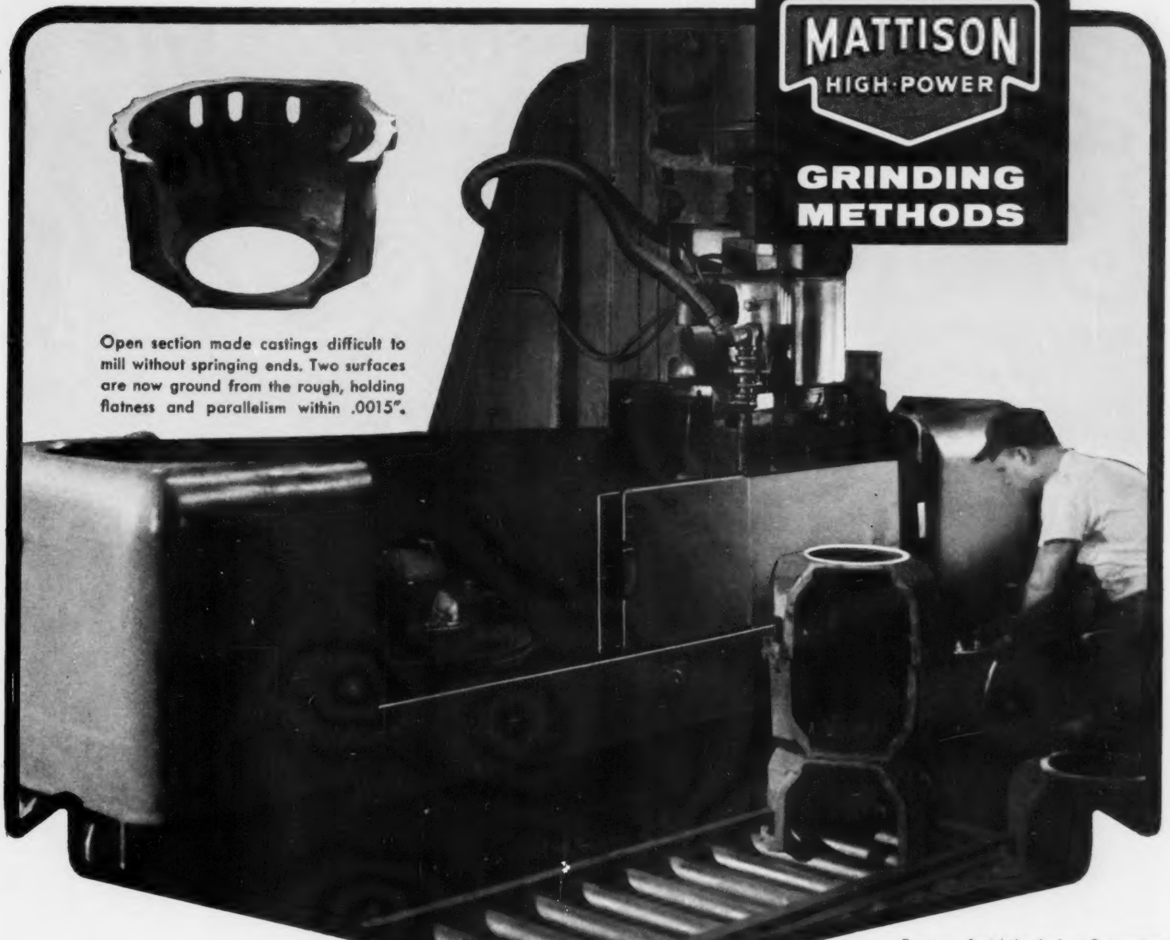
525 LOOMIS ST., ROCKFORD, ILLINOIS

BARBER COLMAN

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 2—TORQUE CONVERTER HOUSINGS

MATTISON HIGH-POWER GRINDING METHODS



Open section made castings difficult to mill without springing ends. Two surfaces are now ground from the rough, holding flatness and parallelism within .0015".

Courtesy—Studebaker-Packard Corporation

Saves two milling operations . . . finish grinding difficult-to-machine casting to close tolerance

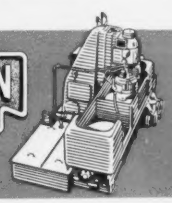
How many facing operations in your shop can be done faster, better, and at lower cost on a Mattison High-Powered Duplex Surface Grinder?

These grey iron castings, for example, were formerly milled (two cuts per surface) and then finish ground to required tolerance. Today, top and bottom surfaces are ground in one operation on a "Duplex Rotary" at the rate of 17.4 pieces per hour . . . removing .060" to .070" stock from each side . . . holding all surfaces flat and parallel within .0015" . . . *one* operator and *one* machine easily doing the work of *two!*

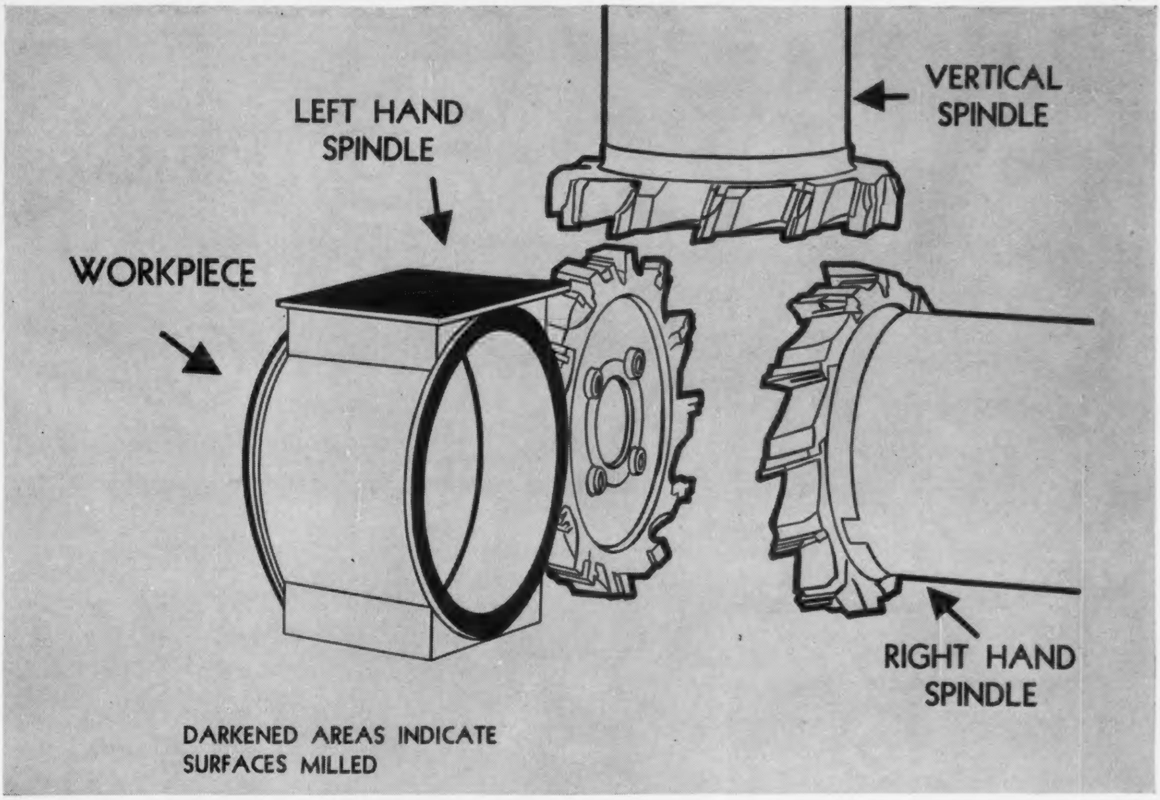
With two rotary tables, the Mattison "Duplex" eliminates downtime ordinarily required for cleaning and loading the table. Operator and machine are *both* more productive. This "all electric" machine is truly easy to operate . . . powered and rigidly built for heavy, multiple-pass grinding of small- or medium-size pieceparts. Why pay more for simple facing operations, or for grinding on a single-table machine, when the Mattison Duplex Rotary Surface Grinder can give you increased production, greater accuracy, and lower cost! Write for Bulletin No. 145.

Parts are rigidly supported to eliminate distortion, permitting perfect alignment when torque converter housing is assembled.

MATTISON MACHINE WORKS ROCKFORD ILL. U.S.A.



HIGH-POWERED SURFACE GRINDERS



loaded in the opposite station. With this arrangement loading time is free.

Previous production of 45 pieces per hour was obtained from two milling machines with two operators. The Triplex produces 110 pieces per hour with one operator. If you have milling work of this nature investigate the possibilities of the Sundstrand Rigidmils.

For practical solutions to your milling problems use

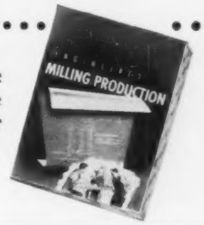
SUNDSTRAND

"Engineered Production"

SERVICE. This is but one of countless milling production problems solved through the use of Sundstrand "Engineered Production". For further information about this service call in a Sundstrand engineer. There is no obligation for this service.

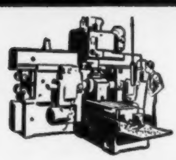
more facts

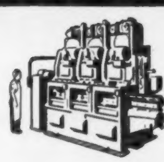
about milling production are contained in this booklet. Write for your copy today. Ask for bulletin 655.



See Sundstrand machines in action in Booth No. 1412 at the Machine Tool Show, International Amphitheatre, Chicago, September 6-17, 1955.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

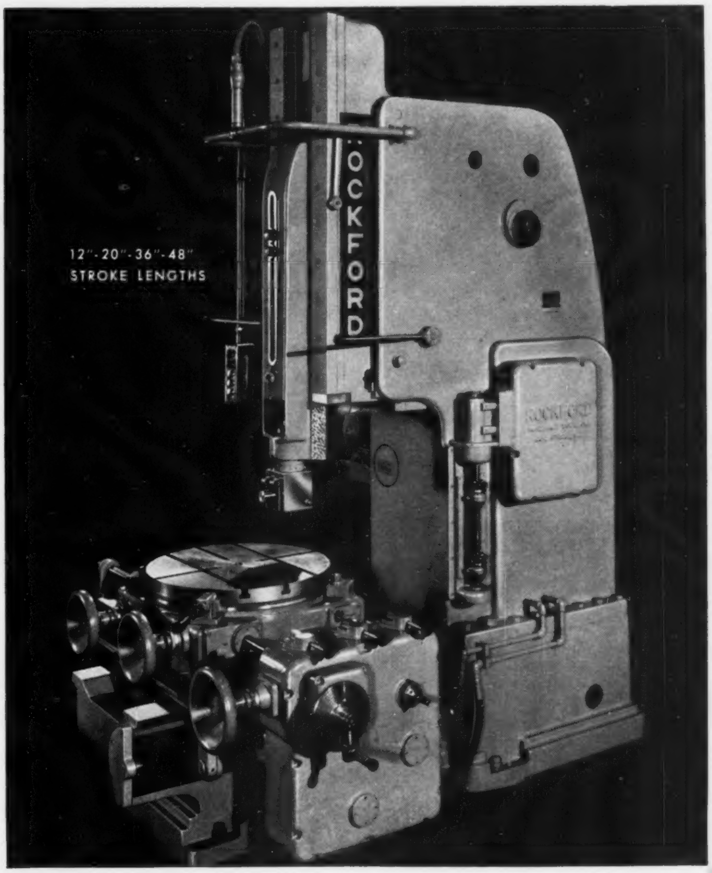
HYDRAULIC

fast, economical production calls for

HYDRAULIC

hydraulic slotters

HYDRAULIC



Hydraulic Drive is a natural for reciprocating-type machine tools. It provides smooth, powerful cutting, fewer moving parts, and longer useful life.

Hydraulic Slotters have power feeds and rapid traverse in all directions, and they may be equipped with Kopy-Kat Duplicators for fast, accurate duplicate-machining. When you modernize your production facilities plan on Hydraulic Shapers, Planers and Slotters to provide the fastest, most economical production methods.

ROCKFORD MACHINE TOOL CO.
2500 Kishwaukee Street • Rockford, Illinois

Hy-Draulic

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

HOW W. F. & JOHN BARNES

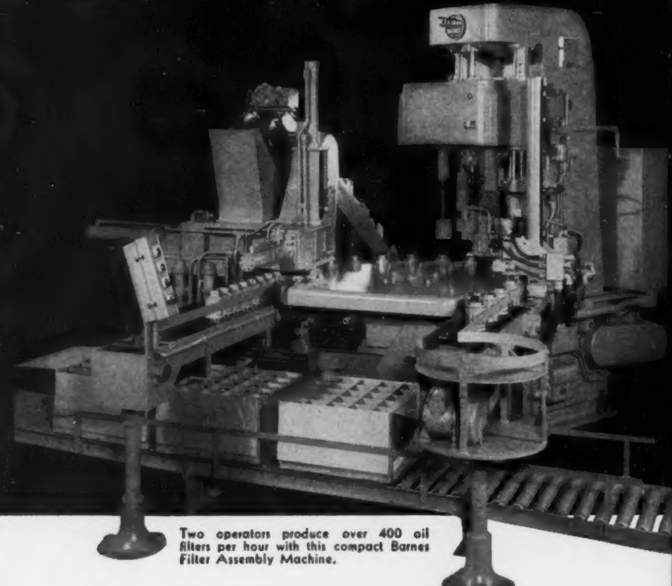
SPECIAL EQUIPMENT

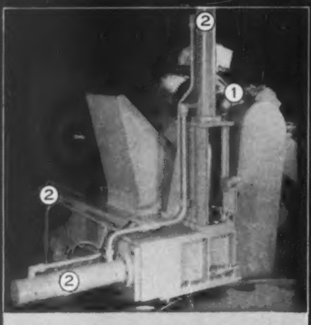
DESIGNING AND

BUILDING SERVICE

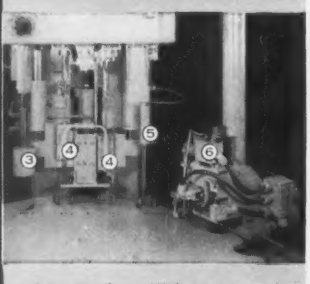
increased production 220%

through AUTOMATIC ASSEMBLY *of oil filters*

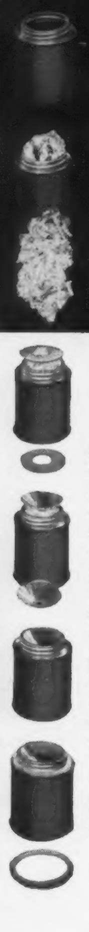




Operator stationed at front of machine feeds empty cans from cartons at the left-hand side. Cans are automatically conveyed to star wheel. Second operator at rear of machine measures cotton waste, which conveyor (1) carries to hopper of compressing and loading cylinders (2). Same operator places wire screen and retainer on filter as it indexes to the next station.



Automatic plunger (3) forces screen and retainer into filter body. Two oscillating air drills (4) weave oil hole through cotton waste. Automatic gauge (5) checks depth of hole, ejecting defective units from machine. Next unit (6) automatically adds cork gasket to complete the assembly. Cartons are moved along conveyor to the discharge side of the machine, where they are repacked with completed filters.



Two operators produce over 400 oil filters per hour with this compact Barnes Filter Assembly Machine.

Oil Filter assembly production boosted from 125 to over 400 units per hour . . . that's the result story of this Barnes Filter Assembly Machine now at work for a large farm implement manufacturer. And equally as important, a higher-quality, more uniform product is being obtained with only one-third the personnel formerly required.

Once again the wide experience of W. F. & John Barnes Process Equipment Division has enabled another manufacturer to substantially reduce production costs and improve product quality. This special machine is only one of many widely diversified types now successfully and profitably cutting costs and increasing production output in hundreds of plants throughout the country.

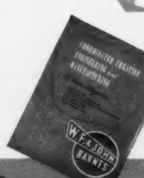
Here at Barnes you'll find the varied engineering and creative skills, PLUS over 75 years of machine building background, to help you solve troublesome production problems. And because all planning, engineering, and manufacturing efforts are closely coordinated, you have available a complete *Automation Equipment Service* from one convenient and *experienced* source.

ASK TO HAVE YOUR PRODUCTION METHODS ANALYZED

Find out how these unique creative and specialized resources can help you cut costs. Your problem will be given expert and individual attention.

GET THIS *Free* BOOKLET

Write today for your copy of "Coordinated Creative Engineering and Manufacturing" — a 32-page booklet of cost-cutting *Automation Equipment* ideas.



W. F. & JOHN BARNES

W. F. & JOHN BARNES COMPANY

PROCESS EQUIPMENT DIVISION

416 SOUTH WATER STREET • ROCKFORD, ILLINOIS

BUILDERS OF BETTER MACHINES AND EQUIPMENT SINCE 1872

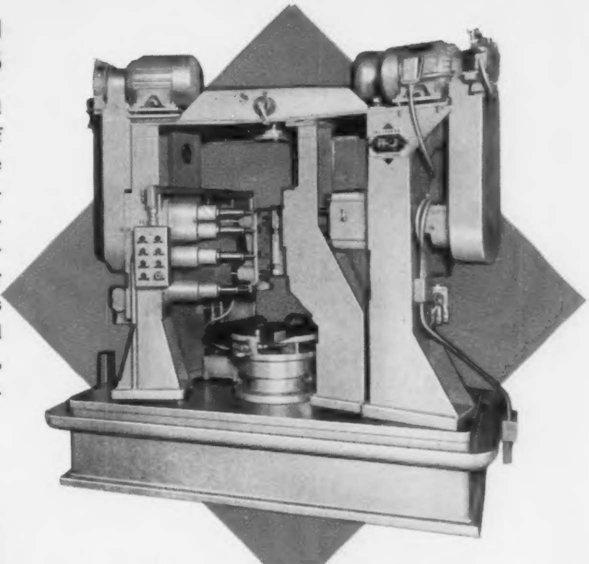
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

Rehnberg-Jacobson

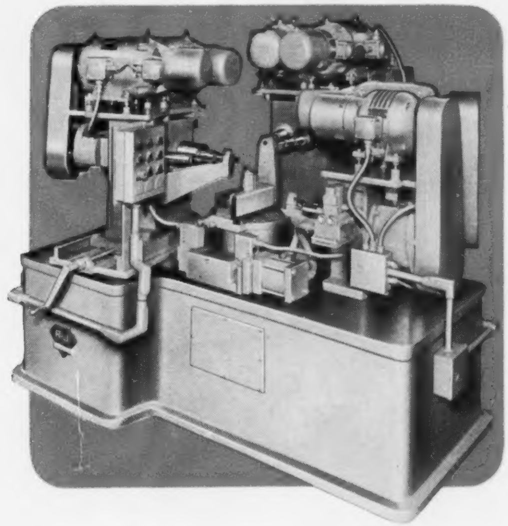
TWO-POSITION RECIPROCATING INDEX MECHANISM HAS ADVANTAGES ON CERTAIN TYPES OF WORK

PERMITS ECONOMICAL APPLICATION OF PRODUCTION MACHINE TOOLS

We have built a number of machines of the type illustrated here, which have enabled the users to enjoy the economies of machine-tooled production at a moderate cost. Usually the pieces have required a two-operation procedure, such as drilling and reaming or drilling and tapping. The distinctive feature of the machines is a two-position automatic index arrangement. The piece is loaded at station one and the operator pushes a button to obtain the fully automatic cycle: spindles advance and retract at station one, the fixture is indexed say 15° or 20°, spindles advance and retract at station two, then the fixture is indexed back to station one for unloading.



This machine performs two operations with four spindles each from the left-hand column, and two operations with two spindles from the right-hand column.



On this machine, three oddly-placed holes are drilled and tapped. The left-hand head is mounted on ways with adjustment for different work pieces.

SMALLER MACHINES COST LESS THAN MULTI-STATION UNITS

This kind of work is often laid out for large multiple-station machines with a continuous-sequence arrangement and possibly fewer spindles at each station. The reciprocating-index machine offers the advantages of lesser floor space and lower cost. It is particularly advantageous where the piece may not call for full-time production. In comparison with producing the piece on standard machines, all the benefits of production-machine tooling are, of course, achieved. A wide variety of arrangements are possible, depending on the work to be done, using drilling, tapping, reaming, boring, milling, and other tooling as needed. *Let us quote on your potential requirements.*

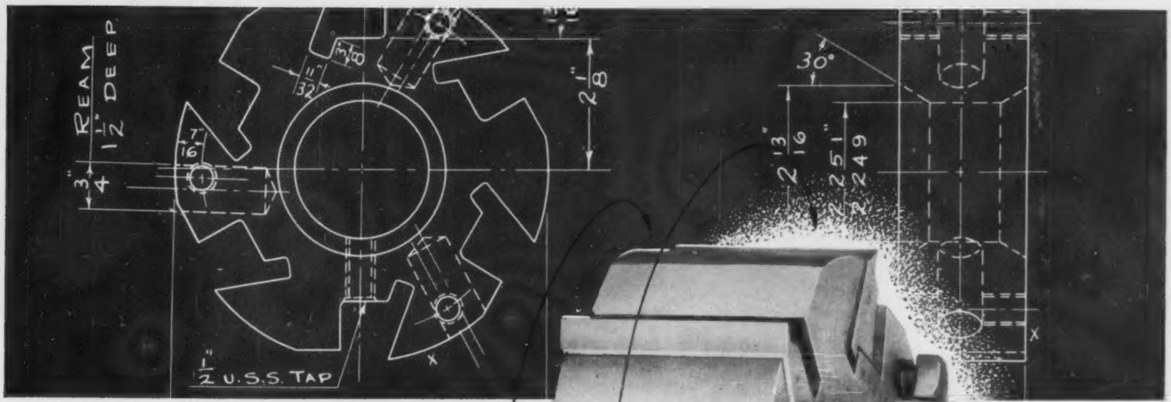
REHNBERG-JACOBSON MFG. COMPANY

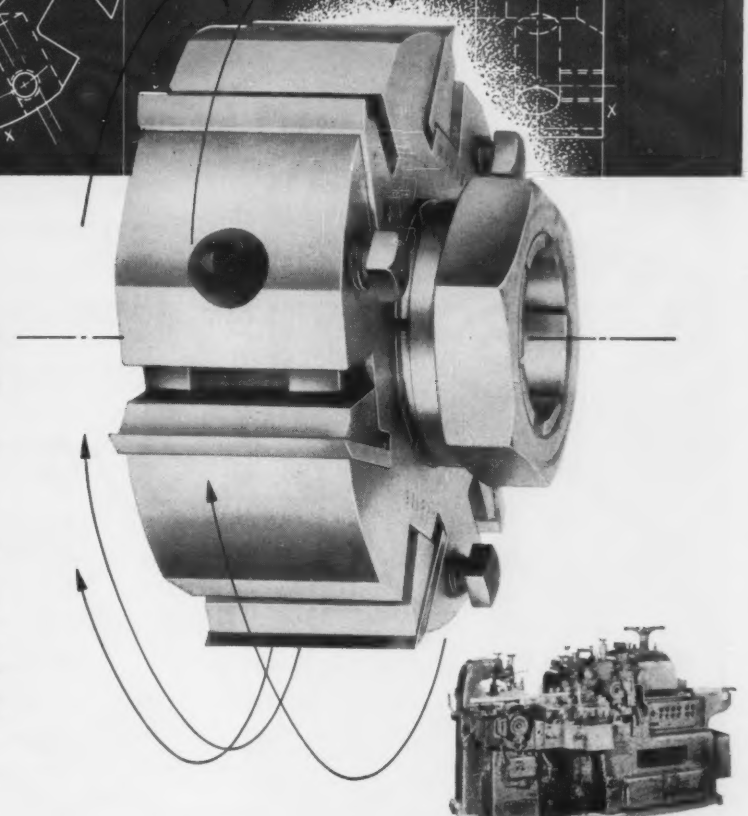
DESIGNERS & BUILDERS OF SPECIAL MACHINERY

R-J

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**





MAX-EL

alloy steel cutter head
for high-speed
electric moulder
finish-machined
after
heat treatment

You're looking at the "firing line" part of Mattison Machine Works' No. 276 High-Speed Electric Moulder. For this cutter head holds six knives that travel at up to 7200 rpm to do the machine's work of fast, vibration-free woodworking.

Hot-rolled Crucible MAX-EL® 3½ was chosen for this vital part. The forged and annealed MAX-EL blank is rough machined, then heat treated to 26-30 Rockwell "C" – *and then finish-machined.*

The remarkable machinability of MAX-EL after heat treatment...its dimensional stability...and its uniformity, which permits heat treating to a very close range of hardness – these characteristics make MAX-EL an ideal choice for vital machine components such as this cutter head.

But try MAX-EL in your own shop. You'll see for yourself how these outstanding properties mean *faster* machining...*fewer* rejects ...*longer* tool life. On your next order for alloy steel – include MAX-EL. For immediate delivery – *call Crucible.*

CRUCIBLE first name in special purpose steels

54 *years of* *Fine* *steelmaking*

ALLOY STEELS

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

Branch Offices and Warehouses: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DAYTON DENVER • DETROIT • HOUSTON • INDIANAPOLIS • LOS ANGELES • MILWAUKEE • NEWARK • NEW HAVEN • NEW YORK • PHILADELPHIA • PITTSBURGH PROVIDENCE • ROCKFORD • SAN FRANCISCO • SEATTLE • SPRINGFIELD, MASS. • ST. LOUIS • ST. PAUL • SYRACUSE • TORONTO, ONT. • WASHINGTON, D. C.

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THE MORE KNOW-HOW YOU PUT IN THE BARREL, THE MORE PROFIT YOU TAKE OUT

Useful facts gathered during Oakite's years of experience in barrel finishing are packed like #12 stones in this 10-page booklet covering such subjects as:

PRECLEANING—Good tank cleaning; Good barrel cleaning; Good rinsing saves money.

CUTTING DOWN, DEBURRING—Good solutions; Abrasive media, water and work ratios, etc.

PICKLING, DESCALING, BRIGHT DIPPING—Good solutions for steel, brass, aluminum, etc.

BURNISHING—Good solutions; Burnishing media, water and work ratios, etc.; How to overcome water hardness; How to keep barrels and media clean; How to prevent rusting, tarnishing and other corrosion.

FREE... For your copy of *"May I put my head in your finishing barrel?"* just write or mail the coupon.

OAKITE PRODUCTS, INC.
26 Rector St., New York 6, N. Y.

Send me a FREE copy of your booklet on Barrel Finishing.

Name____________________

Company____________________

Address____________________

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
REG. U. S. PAT. OFF.
MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada

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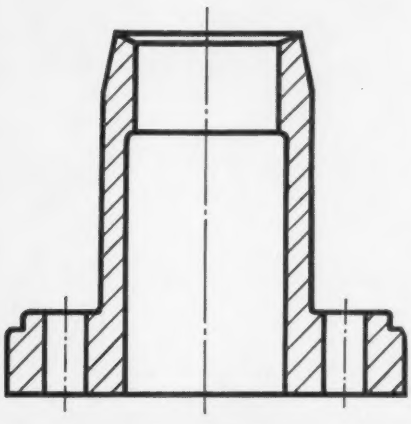
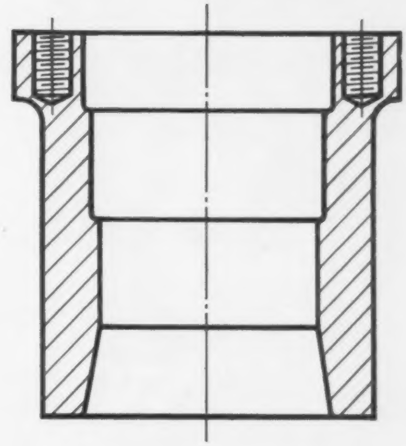
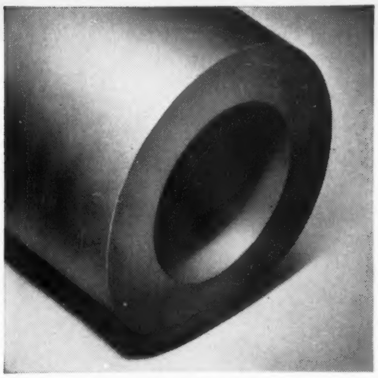
HOW TO MAKE RING-SHAPED TOOL STEEL PARTS FASTER AND EASIER

FORMING AND PIERCING DIE



BLANKING AND FORMING DIE





Graph-Mo Hollow-Bar comes in sizes from 4 to 16 inches O. D. with various wall thicknesses. Immediate delivery on many sizes from warehouses of the distributors, A. Milne Co. and Peninsular Steel Company.

New GRAPH-MO HOLLOW-BAR® eliminates drilling— and machines 30% faster

YOU can eliminate the time-consuming drilling operation when you make ring-shaped tool steel parts from Graph-Mo Hollow-Bar®. The hole comes ready-made. First step is finish boring. There's less scrap, and you use less steel.

On top of that, the rest of the machining's faster—30% faster, compared to other tool steels. That's because Graph-Mo has free graphite in its structure. It means less tendency to pick up, scuff and gall, too.

That same graphite plus diamond-hard carbides give Graph-Mo amazing wear resistance. Users have written us that Graph-Mo outwears other tool steels, on the average, three to one!

Graph-Mo responds uniformly to heat treatment. And no other tool steel is as stable. Proof: after 12 years, a typical Graph-Mo steel master plug gage changed less than 10 millionths of an inch in dimension!

More facts about Graph-Mo Hollow-Bar? Write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

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For more information on products advertised, use Inquiry Card, page 253

An exclusive GRINDING PROCESS...

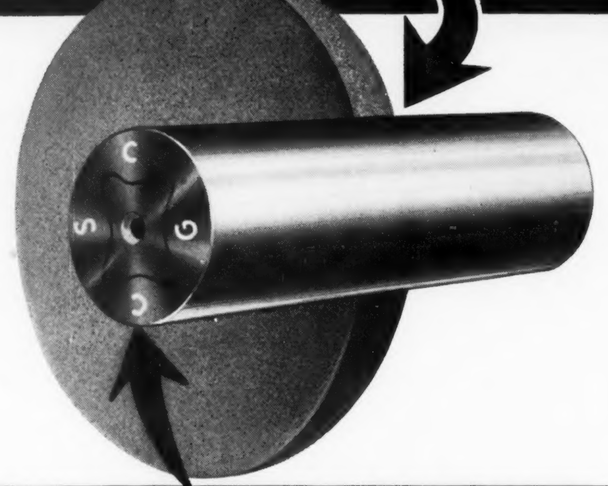
makes

CUMBERLAND

STEEL BARS

concentric, straight,

smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002″ on diameters 1-1/8″ to 2-7/16″ inclusive . . . plus nothing to minus .003″ on diameters 2-1/2″ to 8″ inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

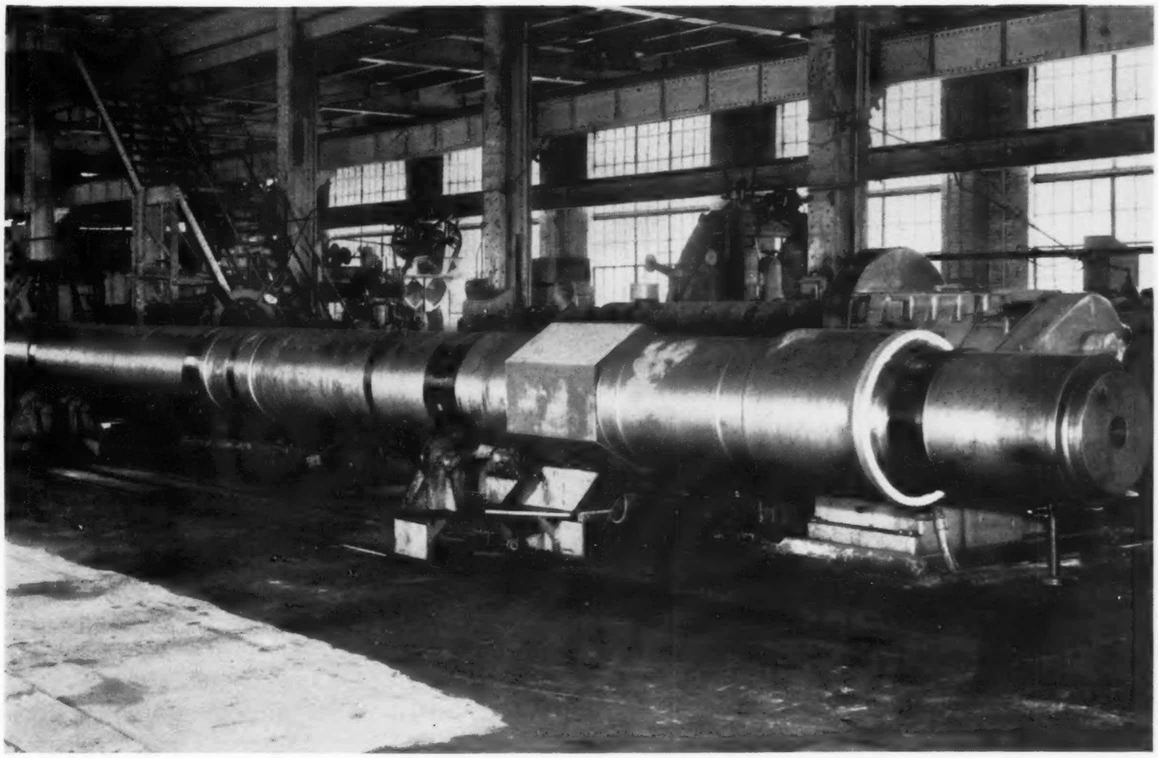
MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 INCORPORATED 1892



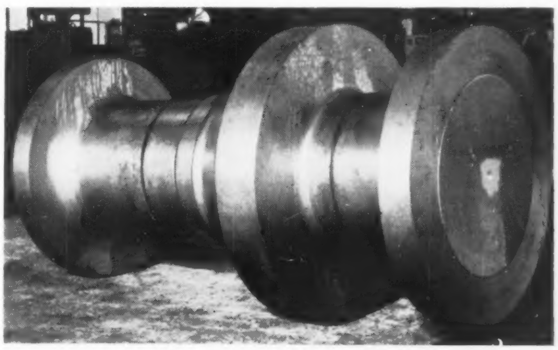
Forged-steel shaft weighs 42 tons; will be used in mine hoist

Above is an interesting carbon-steel forging that is destined to become the shaft for a large mine hoist. As you can imagine, a tremendous amount of work had gone into it before the photograph was taken. The piece was forged, heat-treated, rough-machined, and smooth-bored in the Bethlehem shops, and as you see it here, it weighs in excess of 42 tons. It is 43 ft, 8 in. long.

Forgings like this require special facilities, and Bethlehem has them. We can readily turn out pieces that run a hundred tons or more. On the other hand, we are equally well prepared to produce much lighter items, such as the forging shown in the smaller picture. That one, a thrust shaft, doesn't weigh a full nine tons.

Shafts, of course, are but one of the many types of forgings that Bethlehem makes each year. Through our shops pass everything from giant steel columns to little drop forgings that you can hold in one hand. Whenever you need a forged product of any size, type, or weight, Bethlehem is fully prepared to make it for you and offer a good delivery date.

And please remember, too, that we are always set up to rough- or finish-machine – to your exact specifications.



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

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No. 6 in a series

THERE'S NO COMPROMISE

You send print to Cone

Cone makes recommendations

Cone submits samples of your work

You get demonstration of your work and complete job development record

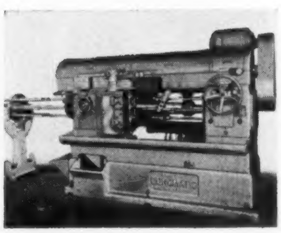
There is no adequate compromise with efficient production practices, if you are in business for a profit.

But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

DATA FOR COMPARISON

Part	Bushing	Length	⅝″
Machine	1⅝″ Conomatic	Hole Dia.	1¼″
Tools	100% Carbide Tipped	RPM	825
Material	8620	Time	14.8 Secs.
Stock Size	1⅝″		



Conomatic

For particulars send for "Four Steps With Cone"

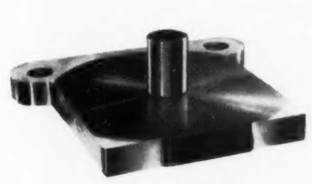
CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

For more information on products advertised, use Inquiry Card, page 253

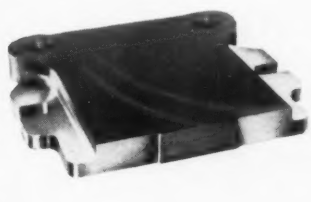
How many different 10x10 DANLY DIE SETS

can you order from stock at your nearby DANLY Branch?

- ☐ 100 ?
- ☐ 1251 ?
- ☐ 4763 ?
- ☐ 31,104 ?



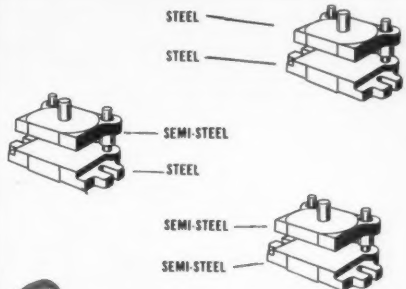
3 different punch holder thicknesses



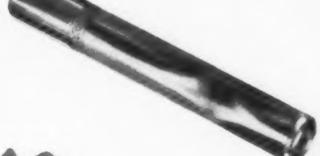
3 different die shoe thicknesses

6 shank size variations

4 bushing type variations

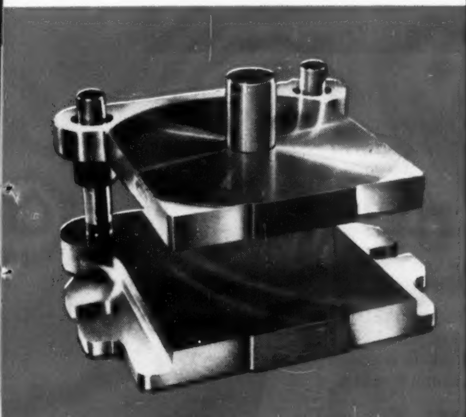


3 different material combinations



16 guide post lengths in each of

3 different styles to choose from



Multiply all of these combination possibilities together and you'll discover that there are *31,104* different standard Danly Die Sets in just this *one* size . . . and all are cataloged and *stocked* in the Danly Branch near you. Amazing? Yes, but it serves to illustrate an important point for *your* benefit. The almost unlimited variety of Standard Danly Die Sets *in stock at your Danly Branch* will meet your specific needs exactly . . . and fast. So remember, when you want the best in die sets in the shortest time, the place to call is your local Danly Branch.

DANLY MACHINE SPECIALTIES, INC. 2100 South Laramie Avenue, Chicago 50, Illinois

Choose the Danly Branch closest to you:

BUFFALO 7
1807 Elmwood Avenue
CHICAGO 50
2100 S. Laramie Avenue
CLEVELAND 14
1550 East 33rd Street
DAYTON 7
3196 Delphos Avenue
DETROIT 16
1549 Temple Avenue

GRAND RAPIDS
113 Michigan Street, N.W.
INDIANAPOLIS 4
5 West 10th Street
LONG ISLAND CITY 1
47-28 37th Street
LOS ANGELES 54
Ducommun Metals & Supply Co.,
4890 South Alameda

MILWAUKEE 2
111 E. Wisconsin Avenue
PHILADELPHIA 40
511 W. Courtland Street
ROCHESTER 6
33 Rutter Street
ST. LOUIS 8
3740 Washington Blvd.
SYRACUSE 4
2005 West Genesee Street

DANLY

DIE SETS . . .
STANDARD OR SPECIAL

DIEMAKERS' SUPPLIES

Wheel guard removed to reveal cutting action.

SLICE THROUGH METAL ...*12 times faster*

RUBBER BOND For wet cutting-off, with smooth, clean cuts free from burr or discoloration. Tolerances can be held within thousandths.

RESINOID BOND For dry cutting at high speeds. Rigid scientific controls during wheel manufacture insure perfect balance, running truth and straightness.

"CARBOFLEX" FIBRE-REINFORCED BOND For portable cutting and slotting, where severe side pressure and heat shock is encountered. Resilient construction gives cushion-like action and maximum safety.

FREE BOOKLET ON METALLIC CUTTING-OFF! Write to The Carborundum Company, Dept. M 81-52, Niagara Falls, New York. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ont.

THE MAN TO SEE IS YOUR CARBORUNDUM DISTRIBUTOR OR SALESMAN He's listed in the yellow pages of your phone book under "Abrasives" or "Grinding Wheels." Call him today—he'll show you how abrasive cut-off wheels by CARBORUNDUM can give you more production at lower cost, whether you're slitting fountain-pen points or cutting heavy castings. He's ready to work with you on any cutting, grinding or finishing problem.

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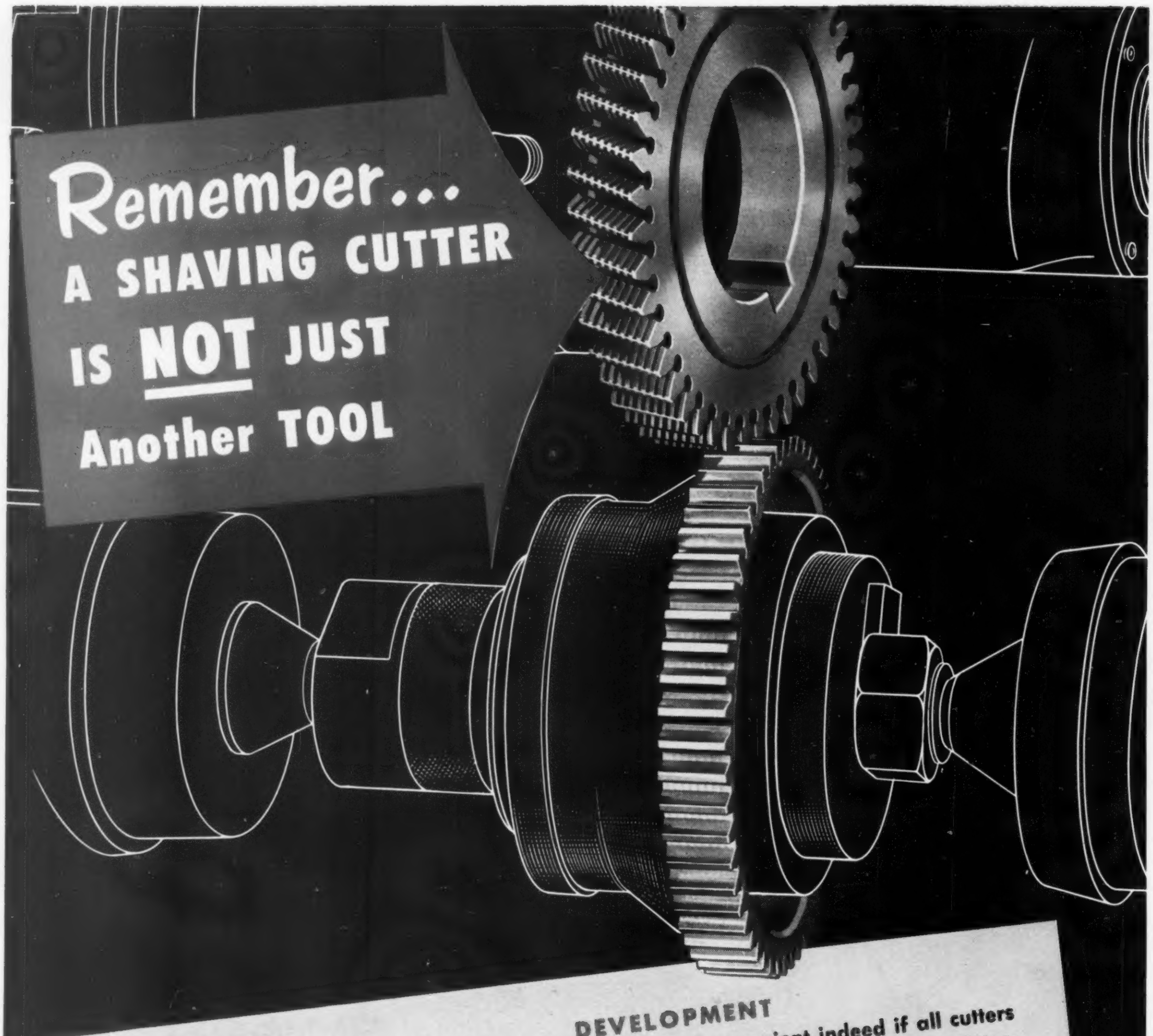

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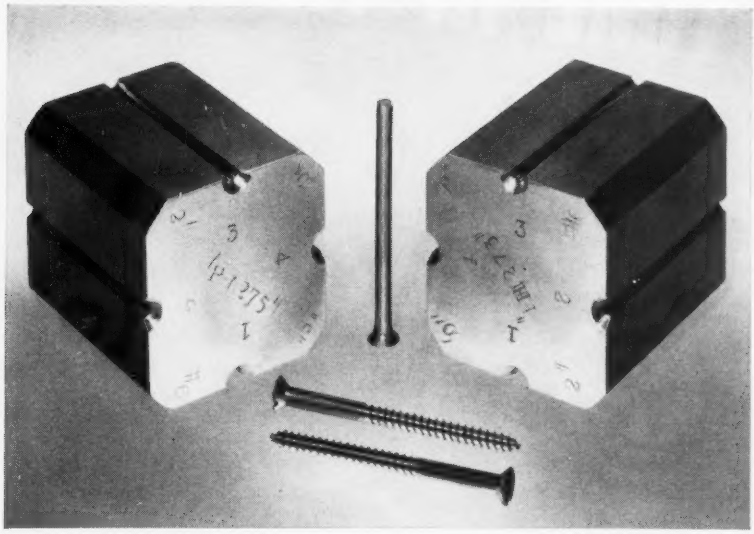
Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



150,000 Screw Blanks per Dressing with This Cold-Heading Die Steel

Shown here are representative header and gripper dies used in the manufacture of wood screws by Southern Screw Company, Statesville, N. C. Made of Bethlehem Cold-Heading Quality Carbon Tool Steel, the dies are hardened to Rockwell C 59/61. They are working tools of a cold-header, and form steel, brass or aluminum stock into screw blanks, turning out up to 150,000 blanks before redressing is required.

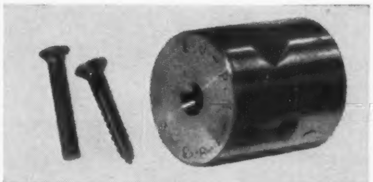
Southern Screw Company reports that they like this grade of Bethlehem Tool Steel because of its ease of machinability, uniformity of heat-treatment, minimum distortion in heat-treatment, good wear-resistance, and good shock-resistance.

Bethlehem Cold-Heading Quality Carbon Tool Steel is a superior grade of tool steel, intended for specialized types of tools where cleanliness and hardenability are important.

TYPICAL ANALYSIS

Carbon, 0.90 to 1.00
Phosphorous, 0.020 max
Sulphur, 0.020 max

Bethlehem Cold-Heading Carbon Tool Steel has high shock-resistance because it is accurately controlled for hardenability. Its controlled carbon range results in good wear-resistance, and provides the



toughness to withstand cold battering.

Ask your tool steel distributor to send you a trial order of Bethlehem Cold-Heading Carbon Tool Steel. You're sure to be pleased with the way it performs.

• • • • • • • • •

DIE OF 67 CHISEL GIVES GOOD SERVICE IN MAKING PART FOR REFRIGERATOR

This blanking, drawing and forming die, made of Bethlehem 67 Chisel Tool Steel and hardened to Rockwell C 52, is used in producing refrigerator unit end caps for a manufacturer of appliances. The caps are made from steel, 3/8 in. thick, approximately 90,000 pieces being turned out before redressing is required. 67 Chisel, our general-purpose, tungsten-type of shock-resisting tool steel, is well known for its wear-resistance, and also for its low distortion in heat-treatment.

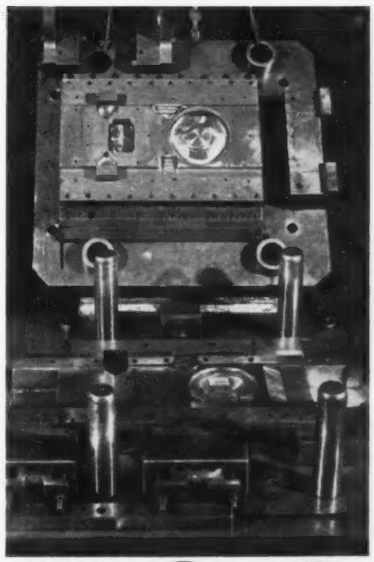
BETHLEHEM TOOL STEEL ENGINEER SAYS:

Bake Tools After Plating

Electroplating with chromium or nickel is often used to salvage tools by regaining worn dimensions, or to correct mechanical errors. It is also used for decorative purposes, and is sometimes advantageous for resisting wear or metal pickup.

Plating of hardened tools is relatively simple. Yet it can be a hazardous operation if it is not followed by tempering or baking. During deposition of the plated metal, a considerable amount of hydrogen is deposited on the tool, and some of it diffuses into the tool, causing extreme brittleness. If the tool is used immediately after plating, breakage in service may occur. To avoid this possibility, temper the tool at from 300 to 400 F for at least four hours, so as to restore its original ductility. This should be done as soon as possible after plating.

Grinding should never be attempted on the steel itself prior to tempering. If tempering is omitted, the tool will gradually recover its ductility at room temperature in from two to three weeks, but will be subject to breakage if used earlier.




SAVE TIME IN TRACING,
HYDRA-TRACE

TURNING, FACING

with Hydra-Trace* *and your* *LeBlond lathe!*

Check the job list of most any LeBlond Lathe—Hydra-Trace combination. You'll find it turning complex dies in the morning, step shafts in the afternoon. Yesterday, it was contour facing compressor discs; tomorrow, turning bevel gear blanks. And saving time on every one!

Hydra-Trace can be mounted in place of the compound rest on most any LeBlond Lathe . . . *in minutes*. It swivels to the most favorable angle for proper tool clearance. Its flat template is easily made, conveniently stored. Template holder and all controls are neatly located at front of lathe. And you can remove Hydra-Trace to use your lathe for other work in practically no time at all!

For complete data on Hydra-Trace, ask for Bulletin HT-2D

American Brass saves 91% of a 6-hour job! Turning mandrels shaped like baseball bats (used in drawing seamless tubing) ate up 6 hours of lathe and operator time at The American Brass Co., Waterbury, Conn. With Hydra-Trace installed on their LeBlond 16″ x 78″ HD lathe, it's done in 30 minutes! And the same lathe, with Hydra-Trace removed, is still available for regular turning, facing and chasing!

If variety is important in your lathe operations, you can't do better than Hydra-Trace and a LeBlond lathe. We'll tell you promptly whether Hydra-Trace will fit the LeBlond you have. Or we can recommend *exactly* the right combination for your requirements from scores of lathe sizes and models. See your LeBlond Distributor or write Cincinnati today.

THE R. K. LeBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO

*Hydra-Trace (Trade Mark registered U. S. Pat. Off.) is LeBlond's heavy-duty hydraulic tracing attachment. Can be mounted in place of compound rest on practically all LeBlond lathes built since 1935.

. . . cut with confidence

LeBLOND *of Cincinnati*

Be sure to see LeBlond, Booth 1313

World's Largest Builder of a Complete Line of Lathes • For More than 68 Years

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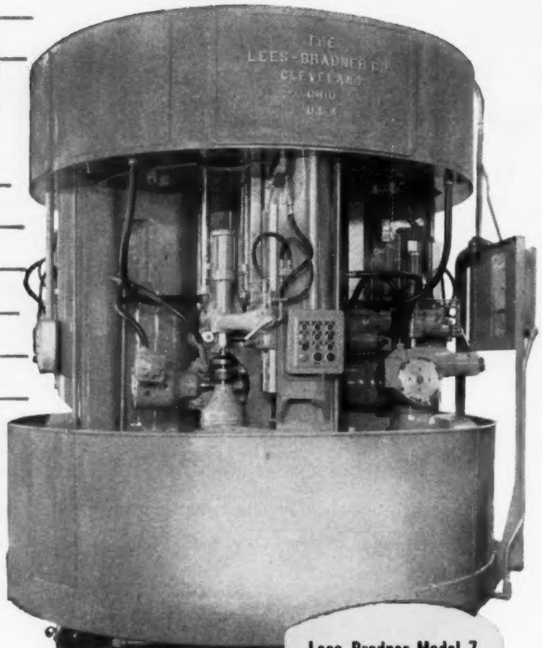
LEES-BRADNER

Sets the HOBBING pace for tomorrow

with 4 machines in 1



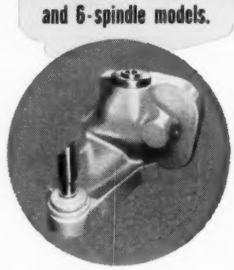
Lees-Bradner Model 7, type HD 8″ x 20″ 4-Spindle Rotary Hobber. Also available in single and 6-spindle models.

Here's a complete hobbing production line in one space-saving unit.

Actually the Lees-Bradner Model 7, Type HD 4-Spindle Hobber is four separate and independently operative machines in one. Each hobbing unit incorporates basically the same automatic, high-production features as the remarkable 7 type HD Single Spindle Hobber. This includes a heavier, more rugged headstock, heavy-duty column and a 10 H.P. motor.

This amazingly efficient machine not only saves valuable floor space but, with its pushbutton controls and automatic features, actually controls the operator thus reducing the chance for human error or slowdown. Chips and coolant are easily carried away from the headstock by the elimination of flat surfaces.

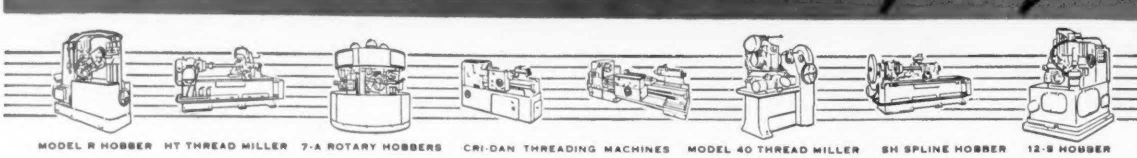
So, if your manufacturing space is valuable and high unit production important, ask your Lees-Bradner representative to give you the story on the ultra-efficient 4-spindle rotary hobber. Write or wire us direct for his name and address in your area.



View of new Type HD headstock with increased bearing surface between column and headstock, heavier casting, coolant and chip carry-away.

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.



MODEL R HOBBER · HT THREAD MILLER · 7-A ROTARY HOBBERS · CRI-DAN THREADING MACHINES · MODEL 40 THREAD MILLER · SH SPLINE HOBBER · 12-S HOBBER

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER

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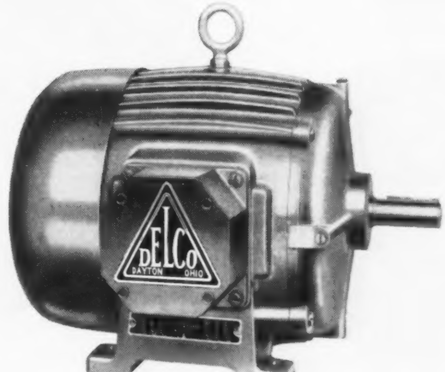

the Delco nameplate is built to one rigid standard of quality, and is thoroughly tested before it leaves our plant. What's more, our Delco engineers will work with your engineers to find the motor best for your job. These are the reasons why Delco is preferred by industry . . . why Delco is best for you.

Whether you require small integral electric motors or totally enclosed fan-cooled giants, you can count on Delco for peak performance and consistent dependability.

GM GENERAL MOTORS

DELCO DAYTON OHIO

DELCO *Electric* MOTORS

DELCO PRODUCTS, DIVISION OF GENERAL MOTORS, DAYTON, OHIO

Proved best by Performance!

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For more information on products advertised, use Inquiry Card, page 253

For Fast Set Up and Positive Accuracy

Use the *DIMENSIONAIR*

Magnifications 2500 to 1 and 5000 to 1

TRY THE DIMENSIONAIR . . . and see for yourself its superior features.

Set in *less than ten seconds* — no time wasted balancing air pressures.

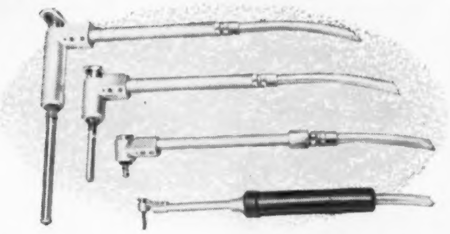
The only air gage made to a definite predetermined accuracy.

The only air gage accurate enough to have a calibrated scale. That's why it can be set to one master.

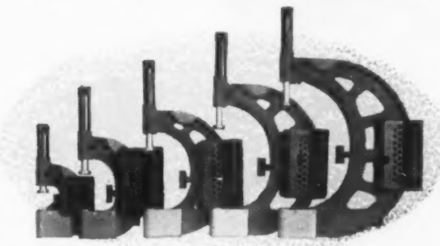
Its calibration is *built into* the gage. You don't read approximate graduations between tolerances.

Don't take our word for it—or anybody's—take your own. Try it, compare it, and use it. Ask us for a chance to operate one.

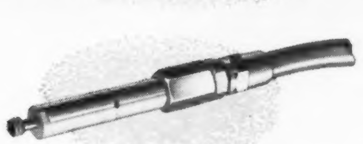
Dimensionair Accessories also have outstanding advantages



ADJUSTABLE AIR BORE GAGES. Only four gages will inspect all holes from ½″ to 8″. Precision-made centralizer locates measuring contacts on hole diameter. Light, well balanced, and not influenced by temperature variations due to handling.



ADJUSTABLE AIR SNAPS. Five sizes provide a combined range of 0″ to 6″. Light. Quick to set to size. Frictionless, sensitive and positive contact. Adjustability is fast and convenient on short runs of various sized parts.



AIRPROBE. Increases the versatility of air gaging. Use it on special gage set ups, multiple gages and where inaccessible places make more conventional gages difficult to use. Actual calibrated readings make tolerance setting masters unnecessary. Longer actual measuring range. Easier to set.

ARNOLDAIR. Simple Attachment for Arnold Grinding Gage "smooths out" the minute bumps and makes more positive dial reading. Makes possible greater uniformity in grinding all workpieces within .0001″. Relieves strain on the machine operator: He *sees* how work is proceeding and can adjust wheel feed to avoid producing scrap.

AUTOMATIC GAGING AND MACHINE CONTROL. The advantages of air gaging are also applied to automatic dimensional sorting, and dimensional control of machine tools. Air gaging also maintains the dimensional accuracy of workpieces at various stages of in-process manufacturing and provides final dimensional quality.

Write us about anything you require in special attachments. Get up-to-date on the Dimensionair: find out for yourself why those who own Dimensionairs say there is no comparison. Our new catalog 54D tells the whole story. Ask for your copy.

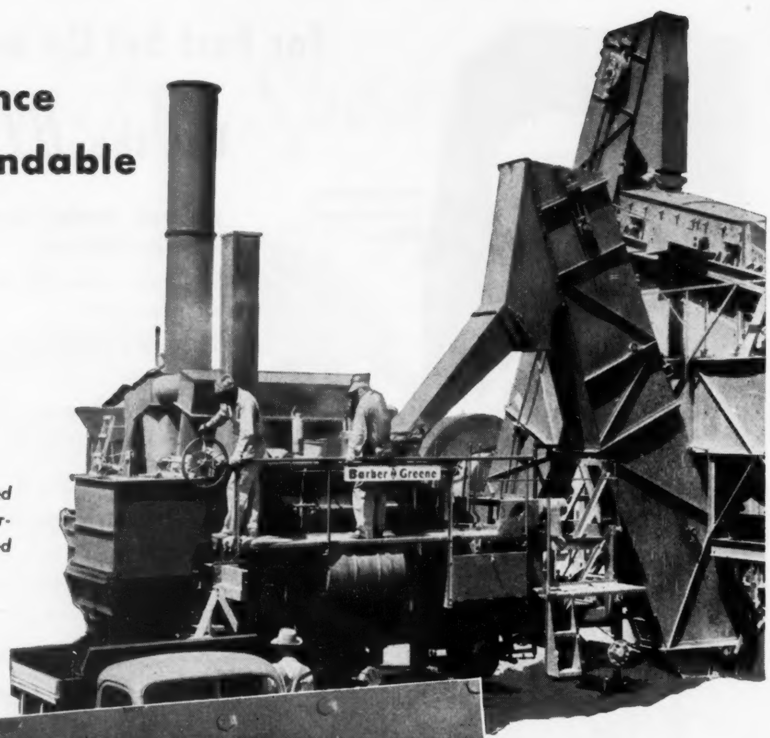
FEDERAL PRODUCTS CORPORATION
5115 Eddy Street, Providence 1, R. I.

Ask **FEDERAL**

FOR ANYTHING IN MODERN GAGES...

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automatically Controlling Dimensions on Machines

machines of great performance use the most dependable oiling system ever developed



A Model 50 Madison-Kipp Lubricator installed as original equipment on a Model 848 Barber-Greene Asphalt Mixing Plant manufactured by Barber-Greene Co., Aurora, Illinois.

MADISON-KIPP *Fresh Oil*

. . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

There are 6 models to meet almost every installation requirement.

kipp

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U. S. A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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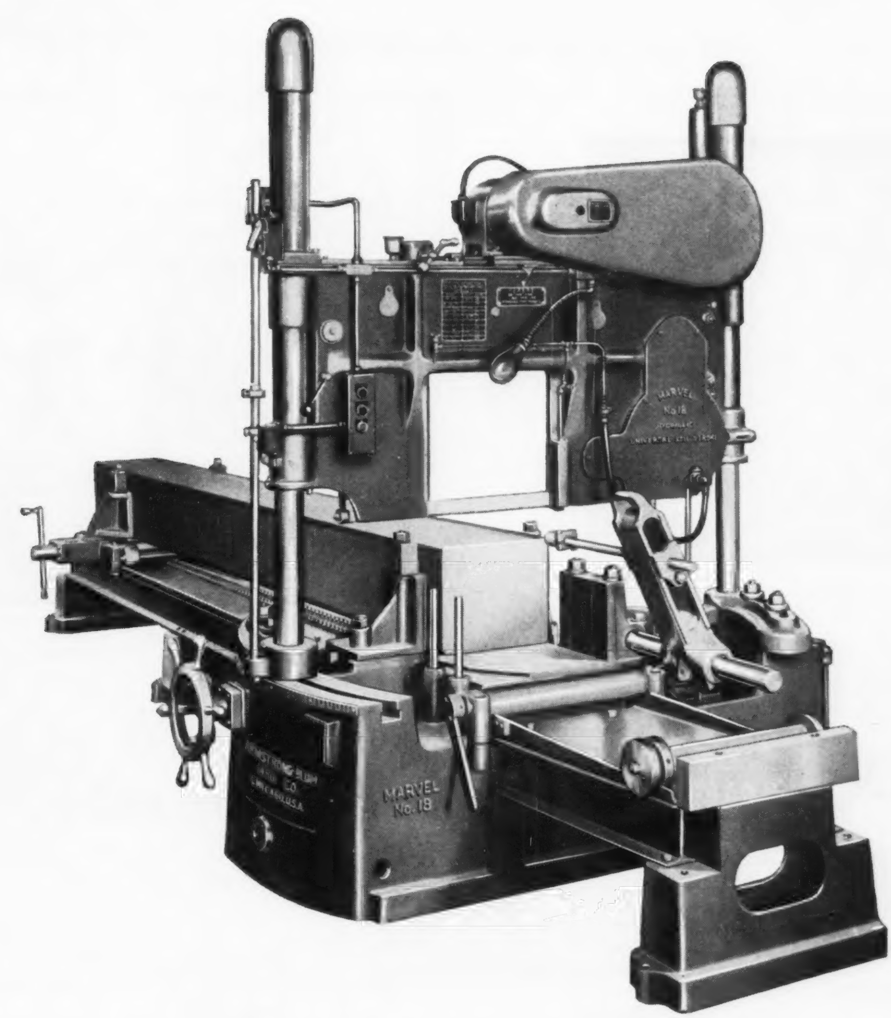


No Job too big or too tough . . .

for MARVEL "*Giant*" Hack Saws

These giant MARVEL Hydraulic Hack Saws (No. 18, Capacity 18" x 18"; and No. 24, Capacity 24" x 24") were *basically* designed for rapid and economical cut-off of BIG WORK. They are not merely "conventional" designs "stretched" to big capacity. They are truly designed and built with the ruggedness and rigidity necessary to withstand the rough treatment of sawing big work, even though the work is in the "toughest of the tough" alloys.

They are reliably fulfilling the cut-off requirements in innumerable steel mills, forge shops, structural shops, warehouses, and machine shops, with assured low tool cost and minimum kerf loss of steel.

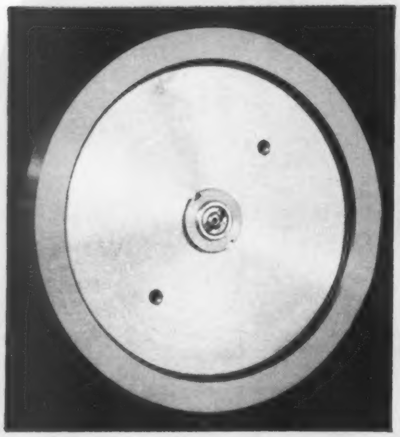
In addition to cutting-off, they are reducing costs by eliminating further machining operations. Heat treated die blocks are being reclaimed for re-sinking by sawing off the worn face; columns, beams, pipe, and tubing are being sawed to *finished*, square ends, eliminating milling; angular sawing is done conveniently by swinging the upper structure on the base, to any angle up to 45 degrees—*without moving the work*.

Contemplating the modern trend toward ever tougher steels and larger sizes, these are the logical sawing machines to buy, not only for today's needs but for tomorrow's as well.

Write for Catalog

MARVEL *Metal Cutting* SAWS
Better Machines–Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.



100% more pieces per grind
300% less tools required per job
400% savings in monthly tool cost

the superiority of ELOX electrical discharge grinding was proved by this large automotive company's unsolicited 2-month comparison report!**

Tool Name, Description:	Solid Carbide Insert	
Part Name:	Crankshaft	
Operation Name:	Finish Front & Rear Thrust Bearings	
	Standard Grind	Elox EDM Grind
TOTAL PIECES PER TOOL	17,290	95,904
MINUTES PER GRIND	21.0	13.75
COST PER GRIND PER MINUTE	$ 1.26	$ .83
ESTIMATED MONTHLY TOOL COST	$294.71	$92.19

in writing Elox will guarantee increased tool productivity over any type of abrasive grinding.

Other Elox equipment available to remove broken taps, drills, etc., from $495 to $3450.

elox* *corporation of michigan*

**Comprehensive report and company name given on request.
*T. M. Reg.

742 N. ROCHESTER RD. • CLAWSON, MICHIGAN

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ANTISEP the all-purpose water-soluble cutting base

JUST LIKE MONEY IN THE BANK

... The Savings from ANTISEP

How's this for economy? . . . Longer tool life, higher quality work, more output per machine and . . . all at a cost of 8c per gallon of coolant in the machine!

Aside from the fact that Antisep All-Purpose Base out-performs even the most expensive straight oils, its amazing cost savings astonish metalworking men the most.

Even so, it has other features that make it popular with machinists. Like its anti-welding properties on heavy-duty work, and its antiseptic qualities which eliminate obnoxious odors in the shop.

Ask to see the proof of Antisep's performance in metalworking plants—the Houghton Man has plenty to show you. A test can be arranged at your convenience if you write to Metalworking Research Department, E. F. Houghton & Co., 303 West Lehigh Ave., Philadelphia 33, Pa.

ANTISEP All-Purpose Cutting Base

... a product of

E. F. HOUGHTON & CO.
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

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Announcing VK MICROGAGES

.000008" ACCURACY

81-BLOCK SET
$250.00

30% *more wear surface than rectangular blocks*

Two really new and important facts should be noted in this announcement by Van Keuren: the closer tolerance of ±.000008" on VK Microgages, and the 81-block combination of 7/8" diameter longer-wear gages . . . now available for the first time.

These fine quality precision gage blocks by Van Keuren are products of the same machine-lapping and inspection techniques as Van Keuren Rectangular and Solid Square gage blocks. Size tolerance as already noted is guaranteed, as well as a maximum surface roughness of 1 RMS. Because their round shape provides greater wear surface, Van Keuren Microgages can be depended on for longer life and lower cost. Their closer tolerance has been particularly developed to meet today's demands for more exacting precision in shop work.

In addition to the new 81-block closer tolerance set featured here, Van Keuren offers 15 other standard sets of Microgages; also Solid Square type sets of gage blocks in .000004" accuracy and Rectangular type sets in .000004" and .000008" accuracy. For further information address: The Van Keuren Co., 178 Waltham St., Watertown, Mass.

"Quality in Millionths"

VK

36th Year

THE *Van Keuren* CO.,

178 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires

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For more information on products advertised, use Inquiry Card, page 253

HOW TO

"GUARANTEE GUARANTEE"

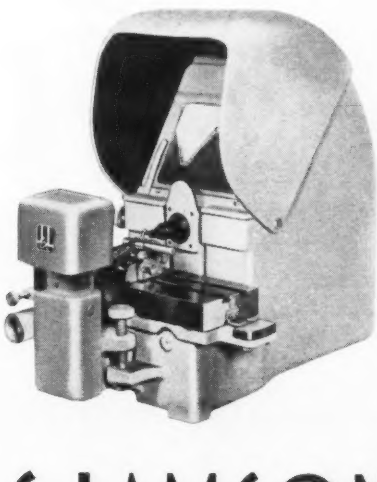
Every set of Jones & Lamson Die Head chasers carries this full guarantee: *to produce Class III threads, or better, across the board.* To insure this guarantee, and to keep manufacturing costs down, J&L carries on successive interoperation inspections the positive way, with Jones & Lamson Optical Comparators.

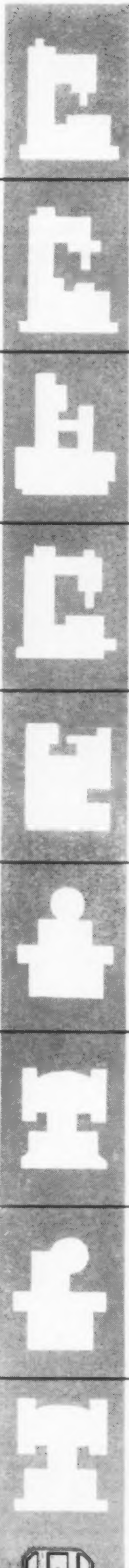
(We practice what we preach)

Avoid costly work on scrap—
Prove machining results before subsequent operations

Controlled quality means lower costs. Use J&L Comparators on *your* production line . . . their versatility is unlimited.

Write Dept. 710 for information on Comparators and/or Jones & Lamson Thread Tool Products.





Dovetails of chasers are straddle milled. Tolerances checked on
The J&L OPTICAL COMPARATOR

Mill angle on front end of chaser. Length and angle checked on
The J&L OPTICAL COMPARATOR

Dovetail angle milled. Angle and centerline checked on
The J&L OPTICAL COMPARATOR

Ratchets for spacing are milled. Chaser length, ratchet form and spacing checked on
The J&L OPTICAL COMPARATOR

Back chamfer is milled. Angle and flat checked on
The J&L OPTICAL COMPARATOR

After heat treating, dovetail is ground. Angles, flats and depth inspected on
The J&L OPTICAL COMPARATOR

Grind thread form. Thread form, angles, root, crests, spacing, lead and helix checked on
The J&L OPTICAL COMPARATOR

Chamfer ground as specified. Angle and amount below root checked on
The J&L OPTICAL COMPARATOR

Top rake ground. End grind and point height checked on
The J&L OPTICAL COMPARATOR

JONES & LAMSON

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

World's largest manufacturer of Optical Comparators since 1919

OPTICAL COMPARATOR DIV.

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ESPEN-LUCAS
PHILADELPHIA
Saves Time... Cuts Costs
Rotary Planer . . . do milling jobs in one-third to one-seventh of time on an Espen-Lucas Rotary Planer.
Big Sawing . . . production cutting of large stock —rapid, easy, straight-to-a-line piece after piece—on Espen-Lucas Cold Sawing Machines.
The ESPEN-LUCAS Machine Works
Front Street and Girard Ave., Phila. 23, Pa.
BUILDERS OF LARGE COLD SAWING MACHINES • ROTARY PLANERS • COLUMN FACERS • HEAVY TYPES OF SPECIAL MACHINERY

Electrical System Fact—Only the new Life-Line "A" motor gives you the unsurpassed corrosion-resistant protection of exclusive new Bondar, Bondite and Mylar* insulations.

*Du Pont Registered Trade-Mark

FACT:

The new *Life-Line A* is the most corrosion-resistant motor on the market

The corrosive action of chemicals takes a heavy toll on conventional motors. The new Westinghouse Life-Line® "A" motor offers more protection against corrosive atmospheres than any other motor you can buy. How?

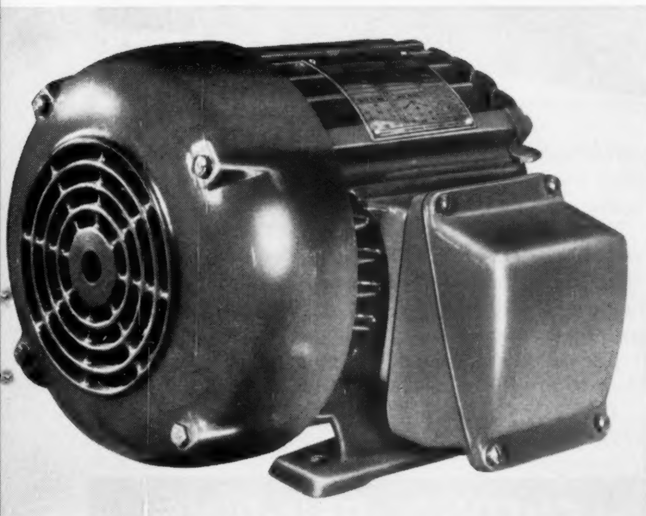
Because the combined improvements in insulation, housing and bearing design give unsurpassed protection against any contamination. It takes the right combination of such improvements in *all three systems*—electrical, mechanical and lubrication—to make the Life-Line "A" industry's most preferred power package.

Get all the facts by calling your Westinghouse sales engineer . . . *The Man With The Facts.*

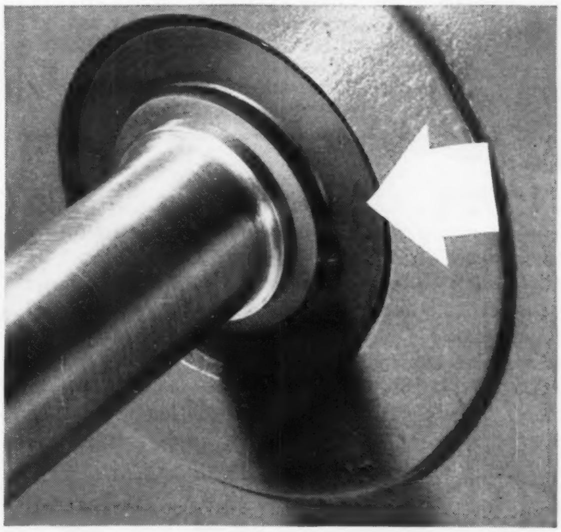
J-21881

YOU CAN BE **SURE**... IF IT'S

Westinghouse



Mechanical System Fact—New cast-iron frames and brackets utilize the finest grained castings with uniformly thick wall sections precisely fitted and sealed. Molded glass plastic cooling fans on totally-enclosed types are chemically inert.



Lubrication System Fact—The new pre-lubricated Life-Line "A" bearing features a "4-way seal"—*two* seals on each side. Totally-enclosed types have additional neoprene flinger which assures bearing protection in any corrosive application.

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LONG TOOL LIFE— CLEAN OPERATION

A 5-Year Report on Texaco Cleartex Oil at Scintilla Division, Bendix Aviation Corporation, Sidney, N. Y.

SCINTILLA DIVISION, Bendix Aviation Corporation, uses *Texaco Cleartex Oil* in these automatics as both cutting fluid and machine lubricant. Results over the past five years have been outstandingly successful.

IN 1950, a few months after *Texaco Cleartex Oil* went into use on this battery of automatics, the following benefits were noted: 1) drills lasted twice as long; 2) uniform hole size was maintained; 3) staining of copper was eliminated; and 4) lubrication expense was reduced because *Texaco Cleartex Oil* serves as both cutting fluid and machine lubricant.

TODAY, Mr. Ray Beames, Supervisor, has this to report: "These benefits are still continuing. *Texaco Cleartex Oil* has solved many of our cutting problems on non-ferrous metals and free machining steel. In addition, there has been *no maintenance necessary* on the lubricating sides of the machines."

There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to help you do all types of machining better, faster and at lower cost. A Texaco Lubrication Engineer specializing in this field will gladly recommend the proper ones for your jobs.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

TUNE IN . . . TEXACO STAR THEATER starring DONALD O'CONNOR or JIMMY DURANTE on television . . . Saturday nights, NBC.

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By LORING F. OVERMAN

Advances in Atomic Energy Set Fast Pace

ONE of the metal-working industry's most difficult tasks is keeping abreast of the amazing strides being made in atomic energy, electronics, and related sciences. Each week, Washington releases some information which shows the effect of scientific developments on weapons, defenses, or procedures.

Buck Rogers Tour

At a recent Open House of the National Bureau of Standards, for instance, speakers commented that they were taking their guests "on a brief Buck Rogers adventure in the new world of scientific wizardry."

The tour included visits to the Bureau's betatron and gamma ray laboratories, and to research laboratories concerned with the precision measurement of length, measurement problems at supersonic speeds, the electromagnetic spectrum, standards and measurements at very high temperatures, fatigue of metals, properties of matter at very low temperatures, high-speed electronic computers and mathematical analysis, rapid and precise analysis of metals and alloys, and measurement of forces up to 10,000,000 pounds.

Practical Application of Atomic Energy

The Navy played host recently to a group of congressmen on an overnight cruise aboard the atom-powered submarine *Nautilus*. Members of Congress were reportedly given the full treatment, including cruising submerged. Understandably, these men were not out for a boat ride. They were being sold on the practicability of atom power for underwater craft. And some of the "tourists" were quoted as predicting the time when such round-the-world underwater vessels would replace all other warships.

Atomic Air Power

Meanwhile, the possibility of atomic-powered air fleets continues to intrigue the Air Force. A sixth contract has just been awarded to explore this field. The new contract—for the design and study of atomic propulsion equipment for planes—has been awarded to the Curtiss-Wright Corporation. Previous contracts have been awarded to Boeing Aircraft Co., Convair Division of General Dynamics Corporation, and Lockheed. These contracts involve studies of airframes in which power plants could be used. The engine design contracts are held by Pratt & Whitney Division, United Aircraft Corporation, General Electric Co., and now by Curtiss-Wright. Atomic-powered aircraft propulsion would permit flights around the world without refueling.

Military Procurement 1956

Defense expenditures in fiscal 1956 for major procurement and production will be about $12,716,218,000—only slightly above the comparable 1955 figure of $12,626,556,000. These figures do not include expenditures for research and development, or for items purchased out of maintenance and operating funds. Expenditures allowed for research and development in fiscal 1956 are estimated at $1,369,000,000, compared with $1,307,000,000 in fiscal 1955. Expenditures for guided missiles will be almost $700,000,000 in fiscal 1956, compared with an estimated $518,000,000 in 1955.

Production equipment expenditures are estimated at $667,788,000 in fiscal 1956, compared with $605,000,000 in 1955. Possible reason for the increase in fiscal 1956 is the fact that the Armed Services are said to be about ready to obligate part or all of the $100,000,000 machine tool fund allowed for mobilization expansion under the Vance Program.

Defense Directives Issued

Two military directives, one from the Air Force and the other from the Defense Department were issued late in March. Both are of interest to the metal-working industry.

The Air Force Directive (AFR 78-18) states the conditions under which manufacturing methods projects will be approved. The paragraphs affecting machine tools are as follows:

"d. For projects involving the development of machine tools and tooling:

"(1) Emphasis will be placed on having a responsible aircraft or aeronautical manufacturer as the prime contractor. The proposed builder normally must be capable of producing additional units if more than one machine is required.

"(2) The potential value of a machine tool will be justified in terms of its adequacy to serve as a prototype.

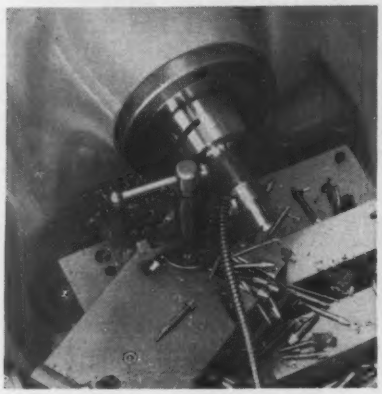
"(3) In cases involving installation in a specific facility, planned production should be of sufficient duration to justify the cost of the project."

In the second directive (Defense Department Directive 4105.10), Defense Secretary Wilson has clarified the department's policy governing placement of initial production contracts for technical or specialized military supplies. Mr. Wilson explained that it is normal policy to make no commitments covering production contracts to holders of research and development contracts. However, he said, these restrictions would not necessarily apply in the case of complex and specialized equipment.

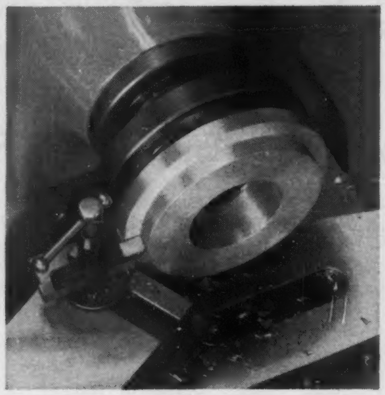
"Where it is in the Government's interest to award such production to a development contractor," said Mr. Wilson, "price advantages alone should not be allowed to dictate an award elsewhere, unless a fair and reasonable price cannot be negotiated with the development contractor, or unless the price advantage in award to another supplier is so substantial as to outweigh the other factors involved. This is not to be construed to require or to prevent competitive pricing. It is, of course, essential that initial production contracts not be awarded to development contractors who do not have fully adequate and available financial, technical, and production resources."

HARDINGE
ELMIRA, N.Y.

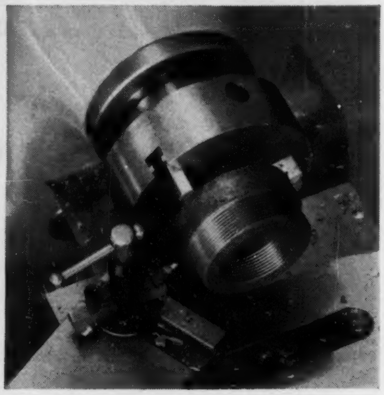
"The Outstanding Tool Room Lathe"



Precision Collet work for all sizes to 1-1/16" Collet seats *directly* in spindle.



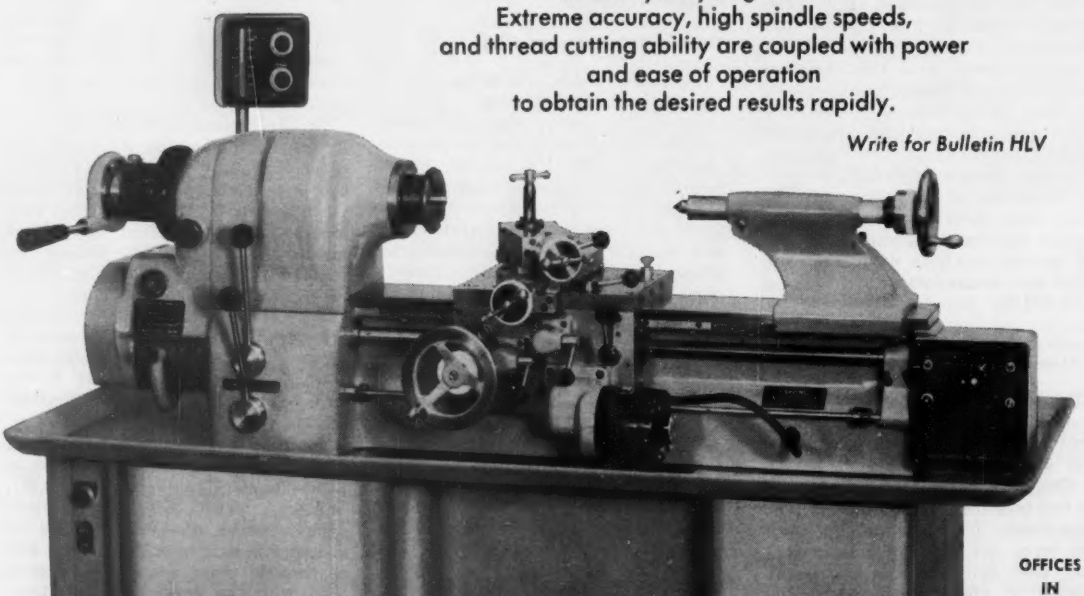
Precision Step Chucks for diameters up to 6". Provides Collet-like accuracy.



Integral Mount Jaw Chucks for precision holding of regular or irregular shapes up to 5".

Hardinge Model HLV 10" Lathe was primarily designed to fill a very old existent gap between the plain precision bench lathe and the heavy duty engine lathe.
Extreme accuracy, high spindle speeds, and thread cutting ability are coupled with power and ease of operation to obtain the desired results rapidly.

Write for Bulletin HLV



OFFICES IN PRINCIPAL CITIES.

Export Office:
269 Lafayette St.,
New York 12, N. Y.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

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Let's Talk More About Profits

BUSINESS concerns frequently seem to be on the defensive with regard to the profits they earn. Some labor leaders imply, particularly in periodicals that go to the rank and file union members, that there is something nefarious about high corporate earnings. Left-wingers are vehement in their references to business profits. They claim that profits are "loot stolen from the worker by greedy capitalists," to quote the Washington Report of the Chamber of Commerce of the United States. Unfortunately, this, and similar statements, have influenced the thinking of a large proportion of the world's population to a discomforting degree.

Business men have been notoriously lax in educating the general public to the fact that profits are the very foundation of our way of life. Unless a company can operate on a profitable basis, it will not have any jobs to offer wage earners. Unless there can be earnings, there is no incentive for anyone to invest finances in new enterprises or even to keep money in existing companies. Actually, labor leaders recognize this fact because the funds of an increasing number of unions are being invested in banks and other businesses.

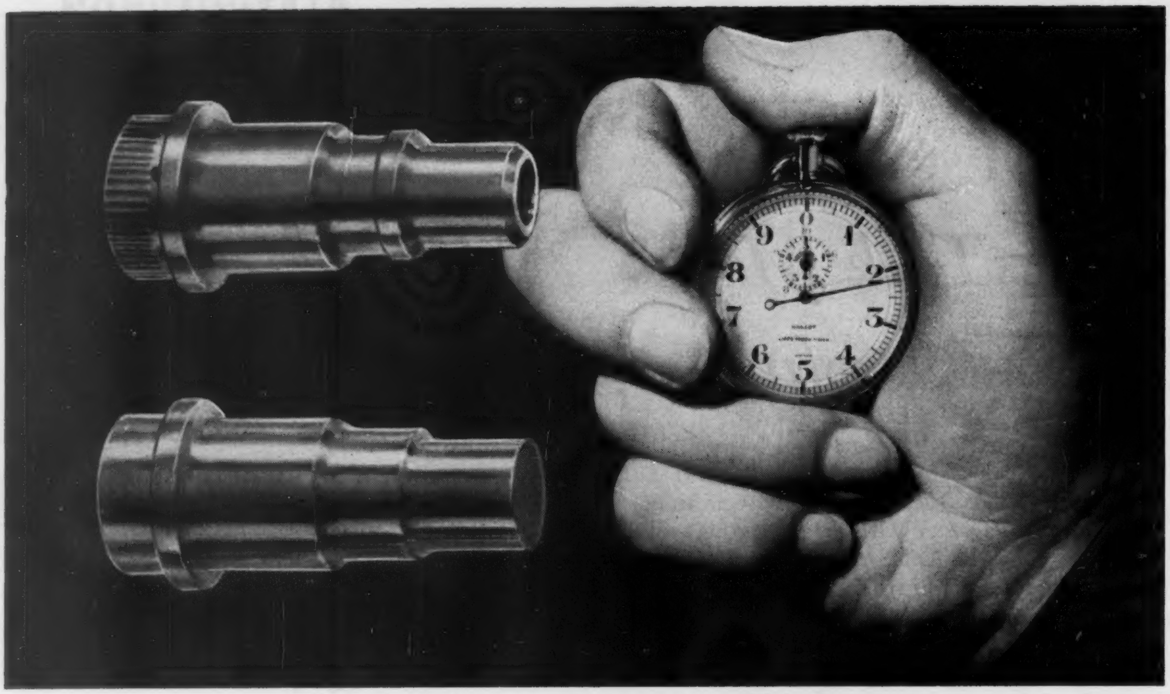
When a concern makes too much profit there is the incentive for other companies to go into the same type business. As a result of such competition, products are soon manufactured in large enough quantities to reduce selling prices. Thus, profits go down to an equitable level. High profits usually, however, indicate efficient management and should be encouraged rather than decried.

Reasonable profits should be considered as a just reward for risking capital. Few persons would invest funds to start a company if there were no chance of a monetary reward. It is because there have been so many people in this country willing to invest their savings and inheritances in business enterprises, that our nation has experienced great prosperity shared more equally than anywhere in the world.

Businessmen should talk more about the true facts of profits to their employes and to other members of the communities where they live or operate enterprises. If their company makes money they have reason to be proud. They are creating jobs and promoting the public welfare.

Charles O. Herb

EDITOR



Finished 50% faster

Using Ledloy from Ryerson

By the time the B-1113 piece was finished, you'd be halfway through a second Ledloy piece. Such greater speeds and feeds are possible with Ledloy because Ledloy contains a *built-in lubricant* which substantially reduces the friction between the steel and the cutting tool.

That built-in lubricant is *lead*—so finely dispersed through this free-machining, open-hearth steel that you can't see it with a microscope. The addition of this small percentage (.15-.35) of lead has no effect on the mechanical properties of the steel EXCEPT to greatly increase machinability.

Ryerson Ledloy machines up to 50% faster than B-1113 . . . tool life is extended as much as 200% . . . and net savings of 25% and more are effected. And Ledloy machines to an unusually clean, smooth finish—case hardens effectively—and bends, crimps, swedges or rivets easily.

Ask your Ryerson representative for the facts about Ledloy or write us direct for engineering data. Ryerson was the first to stock Ledloy and today your nearby Ryerson plant carries the world's largest stocks of Ledloy rounds, squares and hexagons in a wide range of sizes for immediate shipment when you call.

PRINCIPAL PRODUCTS

CARBON STEEL BARS—Hot rolled & cold finished

ALLOYS—Hot rolled, cold finished, heat treated

STAINLESS—Allegheny bars, plates, sheets, tubes, etc.

TUBING—Seamless & welded, mechanical & boiler tubes

STRUCTURALS—Channels, angles, beams, etc.

PLATES—Many types including Inland 4-Way Safety Plate

SHEETS—Hot & cold rolled, many types & coatings

MACHINERY & TOOLS—For metal fabrication

RYERSON CERTIFIED STEELS ®

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CHARLOTTE, N. C. • CINCINNATI • CLEVELAND DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

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ROUGHNESS STANDARDS
Tailored to Meet a Machine Builder's Needs

By MICHAEL W. PAPP, Senior Engineer
Engineering Standards Department
Warner & Swasey Co., Cleveland, Ohio

AWARENESS of variations in the topography of machined surfaces has existed since machining processes were first employed. Not until three decades ago, however, were any concerted attempts made to devise scientific methods for evaluating and specifying these features. Since that time, extensive research by many interested groups and individuals has uncovered a wealth of information that has led to the development and subsequent widespread use of industrial and national standards.

Despite the availability of this data, many industrial organizations have found it advantageous, and in some cases even necessary, to develop their own surface roughness standards. Such standards are based on existing established

concepts, modified to suit the manner of operation of the individual company. The standards now in use at the Warner & Swasey Co. may be used as a case in point.

It was not until 1946 that the subject of surface roughness and its many ramifications received more than cursory attention. Problems brought to light in a comprehensive review of production time standards provided the stimulus for organized action. Methods and standards engineers who were conducting the review in an attempt to establish scientific control of manufacturing costs, were seriously hampered in their efforts by the absence of surface quality definitions on detail drawings. They found that equitable work standards and effective cost controls could not be established without clearly defined quality requirements for each component. Moreover, surface roughness was found to be, undoubtedly, one of the basic elements constituting the composite quality of a part.

Other related undesirable conditions also stemmed from this incomplete definition. For example, examination of finished parts in the stock-room revealed glaring inconsistencies in the surface quality of duplicate items. Many dimensionally acceptable and usable components were condemned as scrap only because inspectors thought their surface quality undesirable. Machine operators were forced, on many occasions, to produce surfaces that were far better than functionally necessary in order to satisfy varying inspection demands. In short, surface roughness was a confusing issue.

Responsibility for finding satisfactory solutions to these and many other allied problems was placed in the hands of a specially organized committee. The committee, composed of representatives from the methods, engineering standards, and engineering departments, initiated action with a comprehensive search for helpful information. All available sources of information including trade journals, technical papers, texts, and existing standards were reviewed, but without success. There were no recorded accounts of applicable systems that would satisfy the com-

Surface Roughness References for Design Application

SURFACE FUNCTIONS	MICRO-INCHES			f - NUMBERS							
	MACHINE GRINDING		HONING OR LAPPING	POLISHING	BUFFING	MILLING PLANING TURNING FACING BORING	REAMING FORMING	SCRAPING	THREADING	MACHINING OF GEAR TEETH	MACHINING OF EXTERNAL SPLINES, SERRATIONS, AND SPROCKET TEETH
	CYLINDRICAL	FLAT SURFACE									
STATIONARY CONTACT											
Adjustable Clamped (Cutter Slides, Gibs, etc.)	*	*	*	[illegible]	[illegible]	3	3	3	3		
Permanently Clamped (Tee Slots, etc.)	*	*	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3		
Gasketed Surfaces		*	-	[illegible]	[illegible]	[illegible]	-	-	[illegible]		
Snug or Interference Fits (Press Fits - Drive Fits)	*	*	*	[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]		
MOVING OR RUNNING CONTACT (Circular Rotating, Rolling, or Sliding Motion)										f_2 FOR ALL APPLICATIONS	f_3 FOR ALL APPLICATIONS
Light or Intermittent Duty	*	*	*	3	[illegible]	3	3	3	3		
Examples: Clearance surfaces which may rub - Lever bosses and holes - Shifter forks, rods, and shafts - Plungers - Guided rods - Sliding gear shafts - Cams and gears which position under no load - Pivots, bushings, or bearings which operate intermittently or under light load.											
Heavy or Continuous Duty	*	*	*	2	-	2	2	2	2		
Examples: Pilot bars - Taper attachment guides - Turret seats - Gear teeth - Moving parts of chucks - Vee belt grooves - Cams which operate under load - Shafts ground for quill bearings - Lead and feed screws - Sliding keys, bushings and pivots which operate continuously or under heavy load.											
LIBERAL CLEARANCE "NO-CONTACT"	*	*	-	-	-	5	-	-	-		
TOP OF GEAR TEETH AND RACK TEETH WHEN NOT CUT WITH TOPPING CUTTER	-	-	-	-	-	[illegible]	-	-	-		
SURFACES FOR OIL SEALS	For roughness specifications to suit commercial types of seals such as spring loaded seals, "O" rings, etc. See General Information in applicable sections of STANDARD PARTS BOOK.										
APPEARANCE (MACHINE TOOLS)										f_3	f_3
Not Open to View	*	*	-	[illegible]	-	[illegible]	[illegible]	-	[illegible]		
Open to View but Inconspicuous	*	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]		
Open to View and Conspicuous	*	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]		
Open to View and Critical	*	*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]		
APPEARANCE (TEXTILE MACHINES - GRADALL)											
Not Open to View, or Open to View but Inconspicuous	*	*	-	[illegible]	-	[illegible]	[illegible]	-	[illegible]		
Open to View and Conspicuous	*	*	-	[illegible]	-	[illegible]	[illegible]	-	[illegible]		
(Note: Specify Cut-off Finish Wherever Practical)											
SPECIAL CASES (By Approval of Engr. Committee)	10 or 16	16	2	1	1	1	[illegible]	-	-	1	-

*Micro-inch values in use at Warner & Swasey Co., have been omitted since practical values for any manufacturing concern are dependent on its line of products and its general policies of product quality.

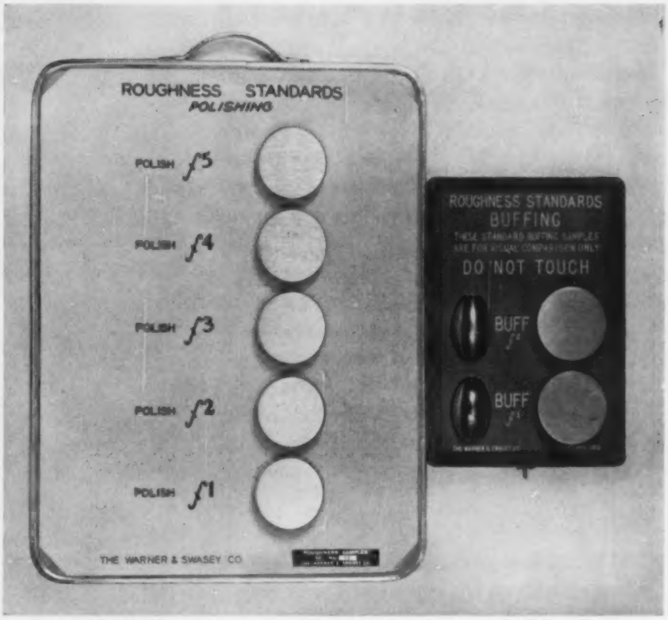


Fig. 1. Roughness requirements for all parts undergoing offhand abrasive finishing are depicted by five specimens. Specimens of buffed parts are also provided for comparing parts having either curved or flat surfaces.

pany's varying needs. Thus it became conclusively evident that an adequate standard would have to be a product of the committee's own efforts.

Today, some eight years later, the effectiveness of those efforts can best be measured by an analysis of the standards that evolved, and the benefits realized since their adoption. The Warner & Swasey Surface Roughness Standards are particularly applicable to the type and quality of product manufactured by the company, yet are broad enough to cover wider fields of application in possible new developments. Their simplicity affords uniform interpretation throughout all divisions of the company. Having been developed by empirical methods, they can be used in estimating and establishing accurate time standards. All roughness standards are carefully controlled, enforced, and maintained by a permanent engineering standards committee.

An integral part of the standards, in the form of an application and reference table, provides engineers with a common denominator for consistently selecting the most economical surface roughness specifications. Simultaneously, standard specimens provide manufacturing and inspection departments with a practical, yet simple, means of interpreting the specifications. Information in the accompanying reference table includes a series of designations for various processes that may be used in producing surfaces having definite functions. Six broad classifications cover all surface functions encountered in the company's line of manufacture. Three of them—stationary contact, moving or running contact, and appearance—contain sub-classifications which further contribute to manufacturing economy. Thus, to select proper roughness specifications, an engineer need only determine the function of a surface and, in some cases, the machining process for producing it. When a surface appears to perform more than one function, the more critical value is applied.

Two types of quality designations appear on the reference table—micro-inch values for ground, lapped, and honed surfaces; and "f" quality numbers for surfaces produced by all other processes. This dual system of indicating roughness qualities was adopted only after long deliberation, and is based on findings that numerical micro-inch values have a limited practical applicability. They are generally considered feasible only for surfaces produced by grinding, lapping, or honing, where irregularities in topography are comparatively small and uniformly dispersed. On surfaces such as these, sensitive measuring devices can be employed successfully to evaluate roughness characteristics in terms of significant micro-inch expressions.

When these designations can be applied, values ranging from 10 to 125 micro-inches are used. Other intermediate values include 16, 25, 40, 63, and 100 micro-inches, all of which were selected from the American Standard Preferred Number Series to represent progressive increases of 60 per cent. To the manufacturing division, every specification of this type denotes an absolute maximum limit of acceptance.

Milled, planed, and scraped surfaces, however, do not lend themselves to similar evaluation. De-

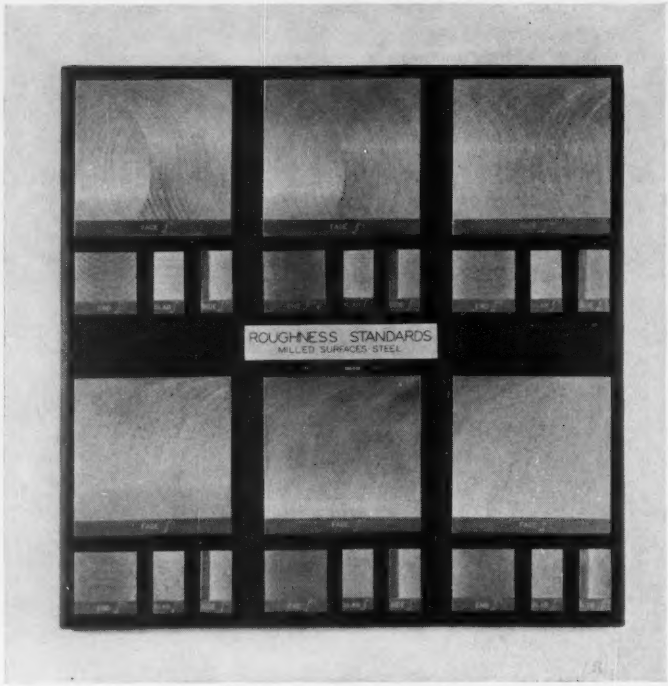


Fig. 2. Four individual specimens represent the type of surface characteristics to be expected with any one of six finish qualities when face, end, slab, or side milling techniques are employed.

fects, or flaws, which inevitably appear, provide the stumbling block. Such defects stem from extremely variable factors such as dull or improperly ground cutting tools, poor machine condition, variations in material, and other such factors. Thus, they usually occur at random, seldom having any major effect on the functional properties of a surface. Yet, on a surface that is evaluated with conventional instruments, they can adversely affect micro-inch readings to the point where rejection of an entire surface or component appears mandatory.

Either of two undesirable conditions may arise. If micro-inch limitations are rigidly enforced by inspection, many functionally usable components are condemned. On the other hand, if manufacturing and inspection departments adopt private compromises as a basis for acceptance, the drawing specifications soon lose any significance as legitimate engineering data.

To circumvent these difficulties for surfaces produced by machining methods other than grinding, lapping, or honing, "f" quality symbols have been adopted. Each symbol indicates a specific quality and is tangibly represented by a standard specimen which portrays the minimum acceptable quality requirements. Numerical portions of the symbols refer to quality levels numbered in the order of increasing roughness. The standard specimens are typical representations of surfaces actually obtained in production. Some, like those depicting qualities of gear teeth,

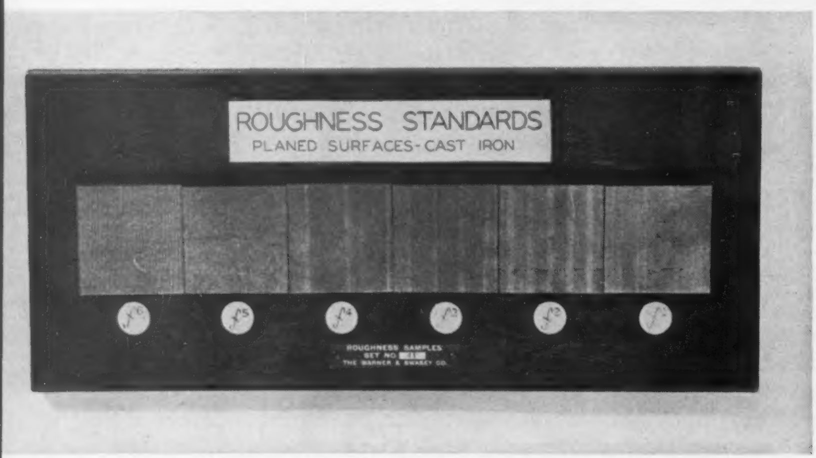


Fig. 3. Surface finish qualities for cast-iron parts that have been planed, ranging from f1 to f6 inclusive, are characterized by six machined blocks.

splines, and threads, for example, actually have the form of the elements they serve to control: others are either curved or flat in order to provide a satisfactory basis for comparison.

It is interesting to note the circumstances that surrounded the initiation, acceptance, and subsequent use of all standard specimens. For several months, immediately following their initial distribution, they were in constant demand. Then, within six months, the demand gradually decreased until they were used only on comparatively rare occasions when controversies arose. Experience has indicated that inspection and manufacturing personnel alike, literally memorize the qualities defined by the specimens, and thereafter effectively apply them from memory to their everyday work.

Five specimens, as shown at the left in Fig. 1, define the company's roughness requirements for all types of offhand abrasive finishing and polishing. They range from a coarse disc-grind for f5, to extremely fine hand polishing with miscellaneous abrasives and rouge for f1. Buffing operations are covered by only two quality classifications because of a narrow range of requirements in practice. To aid in making visual comparisons of either curved or flat surfaces, however, specimens depicting both types are provided for each quality as may be seen at the right.

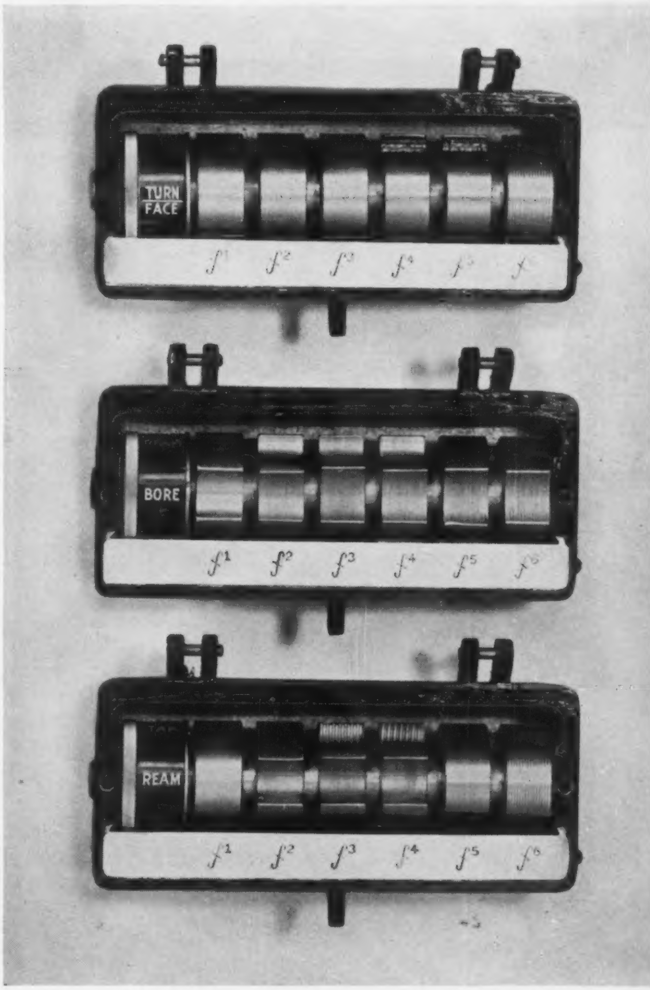
Milling, planing, turning, facing, and boring appear collectively in the reference table because all produce a wide range of surface qualities. As related to the effects produced by a single-point turning tool, these qualities cover a range starting with 0.045-inch feed per revolution for a value of f6, and ending with 0.003-inch feed per revolution for a value of f1. The f6 designation is used only as an intermediate specification for manufacturing and never appears on drawings.

The sets of standard specimens shown in Figs. 2, 3, and the top and center of Fig. 4, define the qualities resulting from these collectively listed processes. Although substantially different in physical appearance, they are correlative. For example, the f2 specimen for any one of the machining methods has surface characteristics which closely approximate those of an f2 specimen produced by any other method. This, from the engineering department's standpoint, is ideal since it allows the manufacturing division the valuable option of selecting the most advantageous of several acceptable methods of production. Reamed holes may be produced at three quality levels as defined by the specimens illustrated at the bottom of Fig. 4.

Photographs, rather than physical specimens, are used to define the three qualities of scraped surfaces. This method of depiction was selected following careful study which showed that the frequency of bearing points is the most significant quality characteristic of scraped surfaces. Thus, although the scraping standard does not define roughness as such, it does characterize critical requirements in a practical fashion. Further clarification for each quality is achieved through a biform illustration, Fig. 5, which portrays the difference between scraped bearing patterns on milled and planed surfaces. As may be noted, the standard also includes stipulations concerning the bearing around bolt holes and the removal of tool marks. The purpose of these stipulations is to eliminate any controversy that might arise during manufacturing.

Acceptable roughness of surfaces on both internal and external threads is represented by

Fig. 4. Six circular specimens are machined on a single shaft to represent designations of surface quality to be expected from turning, facing, boring, or reaming operations.



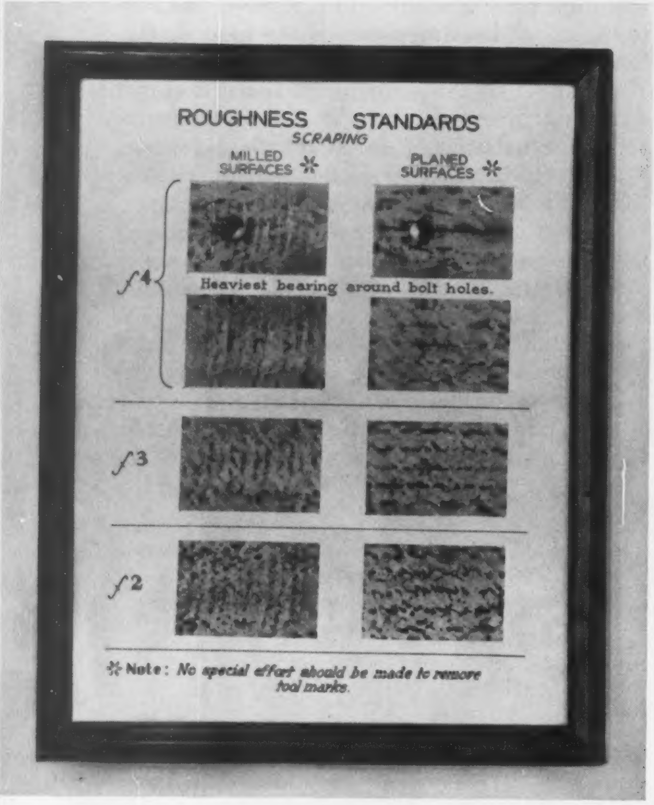


Fig. 5. Photographs replace physical specimens to define the three qualities of scraped surfaces. A comparison is made between the results obtained from scraping both milled and planed surfaces.

two quality designations, f2 and f3. Standard specimens for these classifications, Fig. 6, depict external threads only, but can also be used satisfactorily to evaluate internal threads. Because threads can be produced by a variety of processes, with each process yielding individual surface characteristics, specimens covering each of the most popular methods are provided.

Experience has shown that surface roughness on gear teeth is closely related to the machining methods used rather than to any combination of various cutting speeds and feeds. For example: good commercial quality gears can be consistently and economically obtained by milling, hobbing, or shaping; higher quality gears by grinding or shaving; and extremely high quality gears by lapping. Thus, by specifying the applicable machining method on the detail drawing, desired tooth quality is automatically defined.

For each process, specific definition of surface roughness is provided by a standard specimen, right, Fig. 7, which illustrates the minimum acceptable quality for all gear teeth produced by that process. All specimens are in the form of gear teeth, thereby providing the most favorable conditions for comparing work surfaces. The f2 symbol is applied only in the interest of maintaining uniform surface quality specifications.

External splines, serrations, and sprocket teeth are also covered by a single quality designation. They may be produced by milling, hobbing, or grinding. Beyond indicating the f3 symbol for identification purposes, the engineering department makes no attempt to define the required surface characteristics for such elements by specifying a method. Standard specimens in the form of these various elements, left, Fig. 7, define the lowest quality that will be accepted regardless of the machining methods employed.

One of the most significant results of this surface roughness program is its effect on the estimating and establishing of operational standards. Because every quality designation dictates a specific cutting speed, feed rate, and type of tool or equipment, it is comparatively simple to arrive at reliable time estimates. Estimators

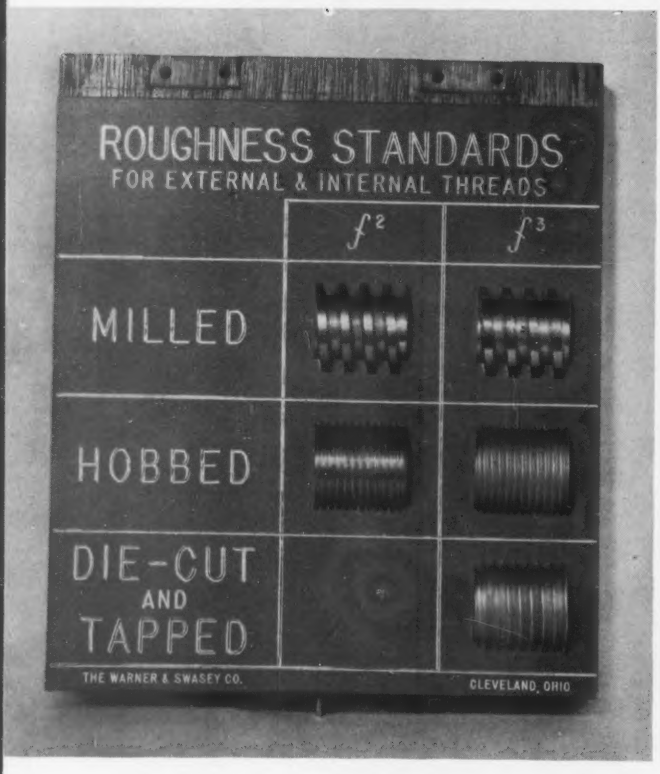


Fig. 6. Roughness standards for both internal and external threads are represented by male threaded members. They are broken down into two surface quality designations and three production methods.

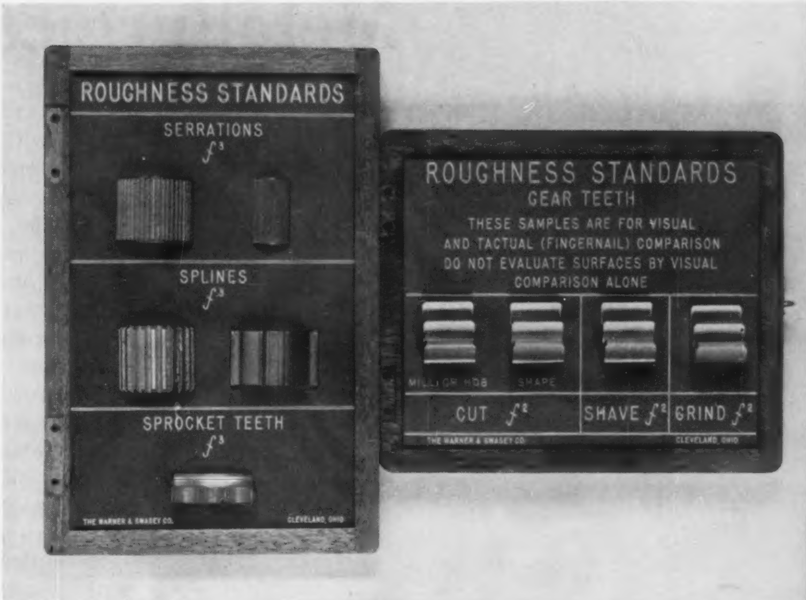


Fig. 7. Surface roughness standards for gear teeth, serrations, splines, and sprocket teeth are depicted by members that have been machined to the designated physical contours.

need only select and add factors from standard time charts for the various qualities and methods specified. The system applies equally well to unfamiliar components still in the form of drawings, as well as to established production items.

A secondary achievement of this surface roughness program is the elimination of controversies and needless waste. Through the use of clear-cut drawing specifications that are completely defined by both words and specimens, there is little opportunity for misinterpretation. Since the basic requirements are not a matter of individual opinion, only components that fall below a specified usable quality are rejected.

Grades of Stainless Steel

EACH of the various grades of stainless steel contains chromium as the essential alloying element. Increases in chromium content above a minimum of 11 per cent produce progressive increases in corrosion and heat resistance. Nickel in substantial percentages is contained in some grades to obtain special characteristics. The familiar 18-8, for example, contains approximately 18 per cent chromium and 8 per cent nickel. Other elements, such as molybdenum, columbium, and titanium are present in some grades for special purposes. To impart free-machining properties, small additions of sulphur, or phosphorus and selenium are made.

Each grade has its own mechanical properties, depending upon its analysis and metallurgical condition. Several free-cutting grades are machinable at speeds up to about 85 per cent of those used with Bessemer screw stock. All stainless steels can be machined with the usual equipment, tools, and cutting fluids employed with Bessemer screw stock.

Armco Steel Corporation, Middletown, Ohio, classifies its stainless steel in four broad grades:

Chromium-nickel grades contain nickel in excess of about 6 per cent, in addition to chromium. They have the highest corrosion resistance of all of the stainless steels, as well as unusually fine mechanical properties. Normally austenitic, they are hardenable only by cold-working, and are non-magnetic, unless substantially cold-worked.

Ferritic-chromium grades do not respond appreciably to heat-treatment, and are designed for use in the annealed condition. In general they are more corrosion resistant than the martensitic-chromium grades. They are strongly magnetic and metallurgically ferritic.

Martensitic-chromium grades are all hardenable by heat-treatment. They are machined and cold-worked best in the annealed condition, and attain maximum corrosion resistance in the hardened and stress-relieved condition.

Precipitation-hardening grades are new stainless steels that combine excellent corrosion resistance, high strengths, and hardnesses with low-temperature heat-treatment. The precipitation-hardening grades open up new opportunities for the use of stainless steel, and are improved materials for many applications where other grades of stainless steel are now used.

Metallurgical Inspection

THOROUGH inspection practices at the Ryan Aeronautical Co., San Diego, Calif., assure the structural soundness of precision parts for jet engines and electronic guidance systems. To accomplish this, the newest "eyes" of science are harnessed—eyes that can see far beyond the ordinary microscope.

Most striking tool of this type is the X-ray machine. The company has expanded its X-ray facilities and now has two complete installations capable of handling large volumes of work. X-rays are a form of radiant energy similar to light waves in that they travel in straight lines, traverse empty space, and affect photographic emulsions. However, they are much shorter than light waves. Visible light falls within a range where the waves are between 3000 and 7500 angstrom units long. (One angstrom unit equals 1/250 millionth inch.) In contrast, X-ray wave lengths run from 0.05 to 2 angstrom units. Because of their short wave length, they can penetrate deep into solid matter that is opaque to light waves.

At Ryan, technicians produce these discerning waves with a Coolidge tube which bombards a metal target plate with a fast moving stream of electrons. As the swift electrons crash into the plate, the kinetic energy in them causes the plate to radiate streams of X-rays. These are focused and directed through the metal part to be examined. After passing through the part, they impinge upon a photographic plate or film and affect its emulsion.

Some of the radiation is absorbed by the metal through which it passes, and this absorption is proportional to the density of the alloy. Consequently, all types of concealed discontinuities in the metal will show up as variations which the rays have upon the photographic emulsion. Hidden welding defects, such as gas pockets, cavities, and shrinkage cracks, appear as darkened areas in the film, because they permit greater amounts of radiation to pass. Inclusions, such as slag, oxides, foreign material, and other bodies, may show up as darker or lighter areas, depending upon the density of the surrounding metal.

By stepping up the power of the cathode gun which fires the electrons and thus releases the X-rays, it is possible to produce more powerful rays with greater penetrative properties. The company's largest machine, seen in the heading illustration, employs a tube which has a maximum output of 250,000 volts at 10 milliamperes. With this power, it is possible to shoot X-ray photographs (radiographs) through 4 1/2 inches of steel. All fusion welds of vital jet-engine components are X-rayed, as well as a variety of castings and forgings.

Imperfections are also detected by a fluorescent penetrant (Zyglo) inspection. This is a sensitive, non-destructive method for finding minute cracks, pores, and discontinuities in all types of metal. In this respect, it is more effective than X-ray inspection, which will not disclose extremely small surface cracks.

In the procedure, the parts to be examined are coated with an oil-base, water-emulsifiable penetrant. This can be done by spraying, as in Fig. 1, or by dipping or brushing. The penetrant contains a mixture of fluorescent particles which glow brilliantly under ultraviolet light. The parts are allowed to stand for approximately thirty minutes to permit the penetrant to seep into all fissures and drain from the surfaces. Then they are washed with a water spray which removes excess penetrant.

While still wet, the parts are sprayed with a developer compound consisting of a colloidal

# of Jet-Engine Parts

suspension of powdery materials. The developer is dried by placing the parts in an oven for five minutes. As the developer dries, it draws the fluorescent penetrant lodged in any crevices to the surface by capillary attraction. By then viewing the parts in a "black light" booth, the exuded particles may be observed to glow with a fluorescent brilliance under the ultraviolet radiation. Both the exact pattern and location of each defect are clearly displayed by the glowing particles. The depth of the defect may be estimated by the amount of penetrant that emerges from the fissure.

Penetrants with exceptionally good properties of surface tension and viscosity can reveal superficial cracks in non-porous materials that are only a few millionths of an inch in size. The technique possesses a particular advantage for parts which are to be reworked at a later time. This is because the fluorescent particles remain permanently in the metal cracks so that once treated, a part may be inspected repeatedly by simply subjecting it to ultraviolet light. Because the method requires various types of equipment, fluorescent penetrant inspection at Ryan is accomplished on a conveyor system that carries the parts through the coating, washing, drying, and viewing operations.

A related but simplified version of the Zyglo inspection method, which is also highly effective in locating defects that extend to the surface, employs a dye penetrant. Requiring a minimum amount of equipment, this method is particularly suited for inspecting in the field and for checking large immobile structures that cannot be handled by other methods. It is frequently possible to check certain parts without preliminary disassembly, such as airplane propeller hubs and landing gears.

The penetrant, which is a fluid of low viscosity and high capillarity containing a red dye, is applied to the surface of the work. This can be done by brushing, spraying, or dipping. A period of five to fifteen minutes permits the penetrant to soak into surface imperfections. Then, all penetrant is removed from the surface by washing the work with solvent. When the parts are dry, a thin coating of developer is applied.

Capillary attraction exerted by the developer will draw quantities of the red dye from any cracks or fissures existing in the metal. These will become readily apparent by contrast against the white background of the developer film, showing the location and extent of each defect.

Unlike fluorescent penetrants, the part will not again show an indication of the defect, when the dye penetrant indication is removed, without another treatment. Because dye and fluorescent

Fig. 1. As part of the Zyglo inspection, the work is sprayed with a penetrant containing fluorescent particles.

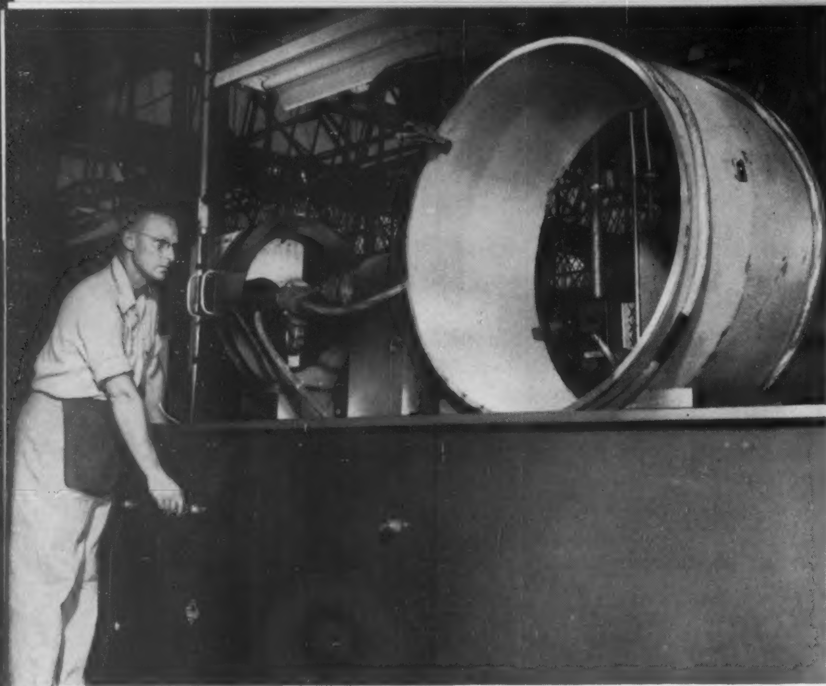


Fig. 2. An electric current is passed through a jet-engine part being Magnafluxed.

penetrants are both reliable means for detecting the smallest blemishes and cracks in the surfaces of all types of metals, Ryan employs one or the other method for examining components. Then, X-raying is used to reveal the hidden imperfections that lie below the surface.

To save time, ferrous materials capable of being magnetized are checked for surface defects by Magnafluxing. This non-destructive magnetic-particle inspection technique is applicable to all sizes and shapes of work. Parts can be checked by covering them with oil and examining them immediately without waiting for processing or drying periods. Proportionately more time is saved when many small parts are to be inspected because of numerous manual operations that are eliminated. A jet-engine part is shown being Magnafluxed in Fig. 2.

The parts are dipped or sprayed with a thin oil containing iron oxide or other particles which respond to a magnetic field. Then they are magnetized either by placing them in a solenoid, excited by an electric current, or by passing a magnetizing current through them. In both practices, finely divided iron oxide particles will adhere to any surface defect, showing its pattern and location.

This phenomenon arises out of the fact that cracks, fractures, or spaces in the metal structure present a pathway having less magnetic permeability than the surrounding metal. As a result, the magnetic field generated "bows out" and passes around the discontinuity. When the break extends to the surface, the magnetic lines of force leak out and form poles that attract the iron oxide particles. If the break lies just below the surface, some magnetic flux may still be deflected to the surface to provide a visible indication of the defect. If the discontinuity lies deeper, the flux may find a pathway within the metal without leaking through to the surface and no indication will occur.

All the foregoing inspection techniques—X-ray, fluorescent and dye penetrants, and magnetic particle—have two characteristics in com-

Fig. 3. The spectrograph films the light that is emitted by vaporized particles of the Inconel metal test piece.

Fig. 4. Elements present in an alloy are shown by the spectrogram on the densitometer.

mon. They are non-destructive in effect, thus lending themselves to the examination of finely finished parts; and they are employed to detect defects or foreign materials existing in the metal structure or created in the process of fabrication. Another interesting technique, spectroscopy, checks the chemical compositions of incoming metals. Technically, while it is not in the non-destructive classification, the few grains of metal consumed are negligible.

The spectrograph machine, Fig. 3, generates an electric spark between two carbon electrodes which vaporizes a very small amount of metal tested. As the metal incandesces, the light emitted is passed through a slit to limit its height and width, and is directed to a diffraction grating. This is a polished concave surface upon which are ruled 48,000 parallel lines in a space of 2 inches. The grating diffracts the light to a strip of film, separating it, like a prism, into its various wave lengths. In turn, the light exposes the film in a series of light and dark bands.

The picture obtained, called a spectrogram, is taken to a densitometer, Fig. 4, and viewed

Fig. 5. With the Metallograph, the inspector can peer deeply into the microstructure of the metal to observe grain structure.

in magnified proportions on a ground-glass screen. Here the pattern is checked against a standard indicating which light waves are present. By comparing with master spectra, it is possible to identify the elements in the test piece. Often, traces as small as 0.001 per cent are detected. Also, a good quantitative determination of each element can be obtained by comparing the intensities of the spectrum bands with standards. If exact amounts are required, a further examination of the sample is made through wet chemical methods.

Like the microscope, the spectrograph depends on the optical properties of visible light, and has a resolving power limited by the wave length of light. X-rays, with much shorter wave lengths, for some time offered a new potential, but could not be harnessed for probing matter because of the lack of a suitable diffractive mechanism. Optical diffraction gratings had spacings which were much too wide, yet as fine as human hands could make them. Then the idea of using the actual spaces between the atoms in a solid body was conceived.

It had been known that atoms in solid bodies were arranged in neat crystalline patterns with spacings that were close to the wave lengths of X-rays. Experiments were conducted in which X-rays were projected through crystals and directed to photographic plates. They were successful in showing that X-rays could be diffracted by this means, and also in substantiating the fact that atoms were arrayed in precise space lattices. The diffracted X-rays bounced off the crystals in a definite direction and intensity which could be measured by the use of the proper instruments.

From these investigations, X-ray metallography has been born. Metallurgists can now examine crystalline bodies using X-rays and from the diffraction pattern of the material tell a great deal about the physical and molecular structure. For instance, it is possible to determine whether the crystals are cubic, hexagonal, or tetrahexagonal; whether heat-treatment has caused structural changes; and whether more than one phase is present.

By bombarding a metal sample with X-rays of specific wave length, it will emit a fluorescent spectrum. Each wave length in the spectrum corresponds to an element in the sample, just as light waves do for the optical spectrograph. Wave-length intensity can be measured by a Geiger counter to determine the amounts of the elements present. With a resolving power several hundred times that of light waves, X-rays are giving the metallurgist new fundamental knowledge of matter. A Metallograph machine in use in the Ryan Aeronautical Co. laboratory can be seen in Fig. 5.

Small Diamonds Bonded to Dressing Tools

In an effort to eliminate waste in mounting industrial diamonds in dressing tools, the General Electric Research Laboratory, Schenectady, N. Y., has developed a flush-mounting procedure. In a conventional mechanical mount, as much as 90 per cent of the diamond may be buried in the tool in order to gain rigidity and prevent loss of the stone. By means of the flush-mounting process, up to 90 per cent of the diamond protrudes.

In this bonding process, titanium hydride serves as a wetting agent and the solder is of a silver-copper composition. The parts are brazed by either induction or radiation heating in a high-vacuum system, or in an atmosphere of pure argon or hydrogen gas. In strength tests, a small diamond tip was revolved at a speed of 56,000 R.P.M., placing a force of about 50,000 pounds per square inch on the bonding area. However, this force was insufficient to dislodge the diamond.

Positioning an industrial diamond on a dressing tool in preparation for vacuum-bonding with titanium hydride and silver-copper solder.

Measuring Hook on Taps

By E. Hart and C. D. Carter
Western Electric Co., Inc.
Hawthorne Works
Chicago, Ill.

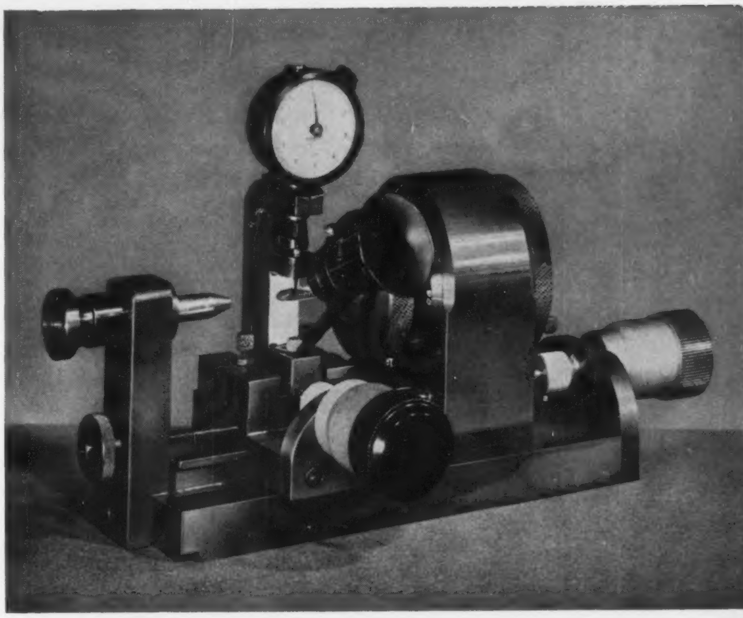


Fig. 1. Chord hook angle of spiral pointed taps is measured efficiently and non-destructively on this mechanical indicating gage.

THE Planning Standards Engineering Department and the Engineering Laboratory at Western Electric Co.'s Hawthorne Works have designed and built a mechanical indicating gage, Fig. 1, developed specifically to measure the chord hook angle of spiral pointed taps in machine screw sizes. In the production of telephone apparatus, ground thread, two-flute spiral pointed taps are used extensively. The bulk of the work is through-hole tapping in ferrous and non-ferrous metal parts, with a thickness equal to or less than the tap major diameter.

This gage is the result of investigations into the causes and possible remedies for excessive tap breakage and short wear life. Also, it was felt that such a gage would facilitate the production of Class 3 and close-tolerance internal threads with standard commercial taps.

Taps from various suppliers were thoroughly analyzed for all factors, especially the geometry and physical elements which affect the cutting action of spiral pointed taps. It was found that new taps of the same nominal size and pitch as received from various suppliers were well within specified limits for such elements as thread angle, lead, and pitch diameter. In general, all of the taps were made to high standards of quality.

Among all of the tap elements analyzed, however, the variation and lack of uniformity in the grinding and spacing of spiral point flutes were revealed as objectionable conditions common to many of the taps analyzed. Examples of the wide variations in the degree of hook (or rake) found within the same lot of taps, as well as the variation between flutes on a single tap, are illustrated in Fig. 2.

The geometry and quality of grinding of spiral pointed taps (especially the hook angle) have important effects on tap wear life and performance. In Fig. 3 are shown the chord hook angles recommended for tapping several different mate-

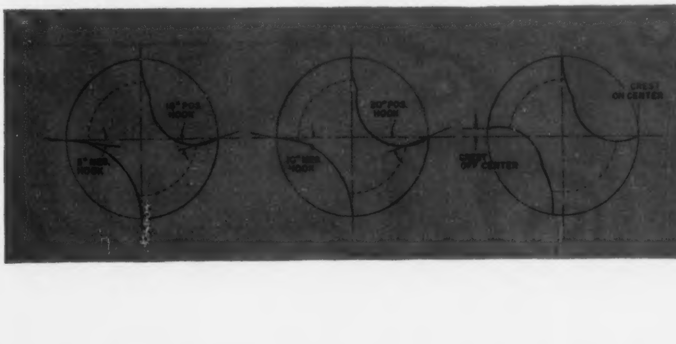


Fig. 2. Variations in hook found on one tap are shown at left, and the variation in one lot of taps, at center. Inaccurate 180-degree indexing of flutes is illustrated at the right.

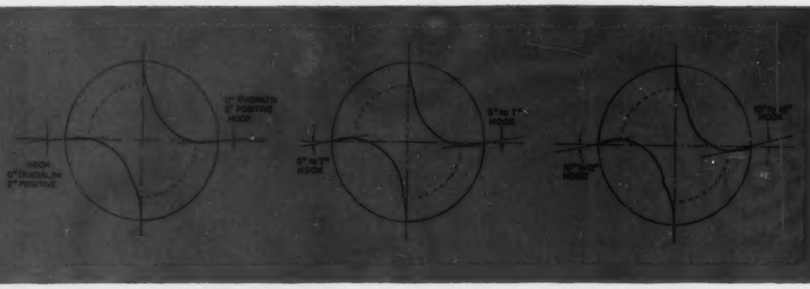


Fig. 3. Chord hook angles for tapping brass (left), cold-rolled steel and magnetic iron (center), and aluminum and copper (right).

rials with spiral pointed machine screw taps. Recommendations for tapping brass are at the left; for cold-rolled steel and magnetic iron, at the center; and for copper and aluminum, right.

The problem of controlling these factors was discussed at length in conferences with interested tap suppliers and users. As the first step in this direction, it was necessary to establish acceptable and workable standards for defining, measuring, and controlling the hook angle on both commercial and precision ground taps.

It was fully appreciated that either the tangential angle or the chordal angle is a true measure of hook on the cutting face of a tap tooth. However, the chordal angle lends itself to a positive non-destructive mechanical method of measurement and has definite advantages over the tangential angle which, at best, may be only approximated by optical measurement or by sectioning and destroying the tap. Finally it was decided that the chordal angle method of measurement would be adopted. In Fig. 4 is illustrated a method of determining the chord hook angle on spiral point taps and a delineation of chordal versus tangential hook.

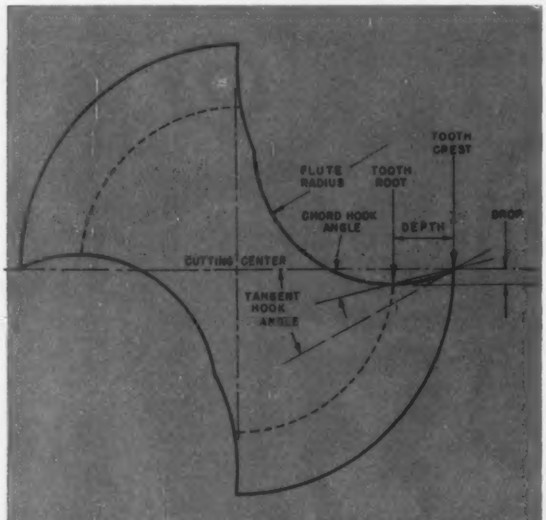


Fig. 4. Method of determining chord hook angle on spiral point taps. Diagram also shows difference between chordal and tangential hook.

To measure the amount of hook on a tap tooth, the gage indicates the cotangent elements of the chord hook angle, which is the angle formed by the radial or cutting center line of the tap and the chord of the flute arc passing through the crest and root of the measured tooth.

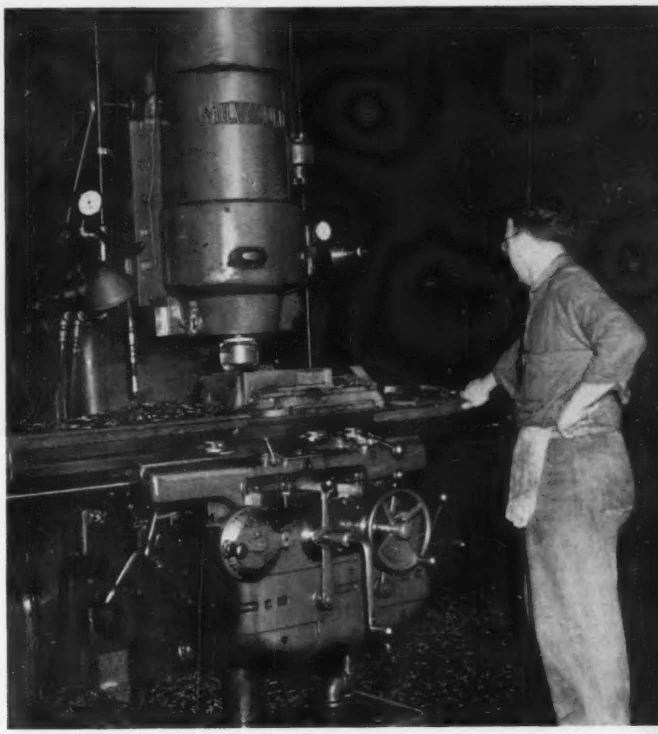
In operation, the tap is chucked by its shank or mounted between centers in the gage, and is moved longitudinally by the chucking-head micrometer to center the measured tooth with the indicator point. By rotating the chuck slightly and operating the cross-slide micrometer, the tooth crest is located on center, as indicated by the zero position of the dial indicator.

The indicator point is then moved axially across the tooth face a distance equal to the known basic full "depth" of the thread, which places the point at the thread root line. In this position, the indicator drop (or rise for a negative hook) is observed on the indicator dial. Thus, having measured two sides of the triangle which contains the hook angle, the amount of hook (in degrees) on the tap tooth face is readily found.

By the introduction of this new tap hook gage and adoption of the chord angle method of measuring hook, some important advantages and benefits are provided to tap manufacturers and users alike in the problem of improving the performance of commercial taps. The improved inspection control for purchased taps which the new gage provides has resulted in more accurate and better controlled tap point grinding and flute indexing by the manufacturers.

From the economic standpoint, the gage has been most effective in its application to the sharpening of worn taps. It is estimated that throughout the industry not more than 25 per cent of potential tool life is realized from small-size taps, due primarily to improper grinding and failure to resharpen dull taps repeatedly to utilize their full tool life. In this regard, the new indicator gage for measuring tap hook is particularly valuable for grinding machine set-up and control of the tap sharpening operations.

Milling with Carbide Can Be Profitable



Familiarity with the characteristics of carbide milling cutters will dispel any doubts as to the advisability of their use. First of two installments

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HIGH productivity at low cost-per-piece is an accepted standard of operation by that portion of the metal-working industry engaged in profitable carbide milling. In addition to being readily adaptable for machining various materials, the carbide milling cutter insures a smooth, precise finish, even on deep cuts and with heavy chip loads. Also, the necessity of coolants is minimized as the heat generated during cutting is absorbed by the chips, leaving the cutter and work-piece comparatively cool.

It is the concerted opinion of many experienced shop men that the entire subject of milling with carbide is too often presented in a manner difficult for the average production man to thoroughly digest, thus preventing its efficient and economical practice. Nevertheless, profitable carbide milling is well within the grasp of the vast majority of metal-working industrial shops. Not only is it possible, but it can be achieved with the available equipment and operator personnel.

Production Costs Reduced

In one heavy manufacturing shop, two parallel flats are milled across an S A E 4140 steel forging 10 1/2 inches in diameter by 53 inches long. The rough, scaly work-piece is to be the shank for a 300-ton capacity hook used for maneuvering oil-well drill pipe. A 3/4-inch deep cut is taken across each 9-inch wide by 45-inch long flat on a Cincinnati Hydromatic milling machine. A face mill with inserted carbide blades operates on this part at a speed of 250 surface feet per minute at a table feed of 6 inches per minute, Fig. 1. Ten passes per cutter grind are obtained.

Another example of the kind of production runs that can be expected when milling with carbide is that of an automotive parts concern which is machining 3500 cast-iron gear-cases, Fig. 2, per cutter grind. The Davis & Thompson milling machine is of the drum type, and is powered by a 20-H.P. motor. Four 12-inch diameter inserted-blade face mills are operated at a speed of 250 surface feet per minute and a feed of 26 inches per minute, producing a 0.009-inch chip load per tooth at a 3/16 inch depth of roughing cut. Reconditioning dull cutters takes less than one hour per cutter due to the simplicity of grinding solid carbide blades.

A rough job of milling flats on roll journals, Fig. 3, is being done at a steel mill. Tough alloy steel is being cut by a 12-inch diameter inserted-blade face mill mounted on a Cincinnati milling machine having a 20-H.P. motor. At a spindle

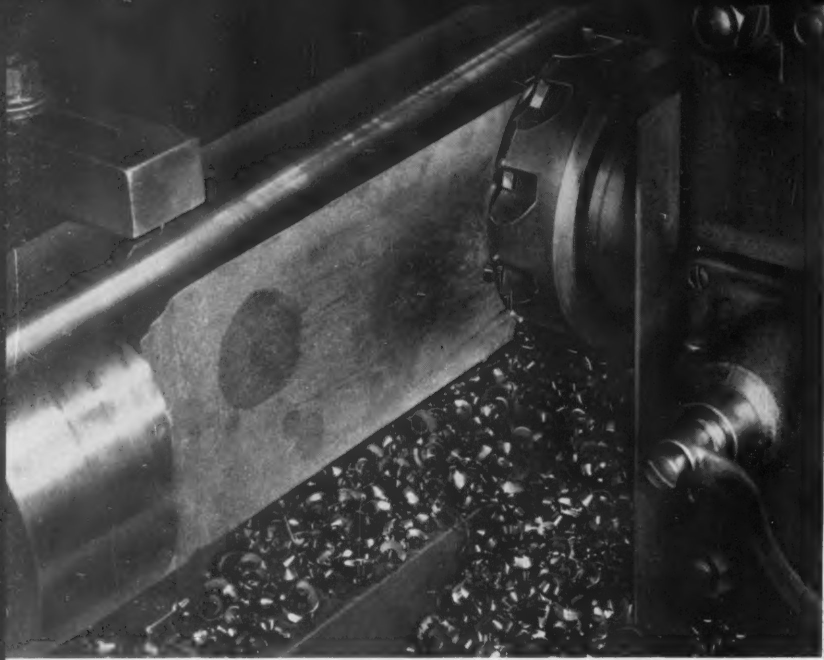


Fig. 1. Face-milling cutter with inserted carbide blades machining flats on an alloy-steel forging. A cutter speed of 250 surface feet per minute, with a feed of 6 inches per minute, is used.

speed of 100 R.P.M. and a feed of 10 inches per minute, a 7/16 inch depth of cut is taken during each pass of the cutter.

Four Basic Factors Involved

Profitable milling with carbide results from the observance of four basic factors: (1) an intelligent selection of a carbide milling cutter to suit the job at hand; (2) the use of a milling machine possessing at least average qualifications regarding rigidity and available power; (3) an adequately supported work-piece of a design capable of withstanding the pressures associated with high metal removal rates; and (4) the service of a machine operator having an adequate knowledge of the basic operating characteristics of carbide milling cutters. The key to the whole situation, therefore, resolves itself into the following simple equation: proper carbide *cutter* + adequately powered milling *machine* + rigidly supported *work-piece* + sufficiently informed *operator* = *profitable carbide milling.*

To begin with, although the carbide milling cutter is often misrepresented as a complex tool, it is actually no more difficult to understand and

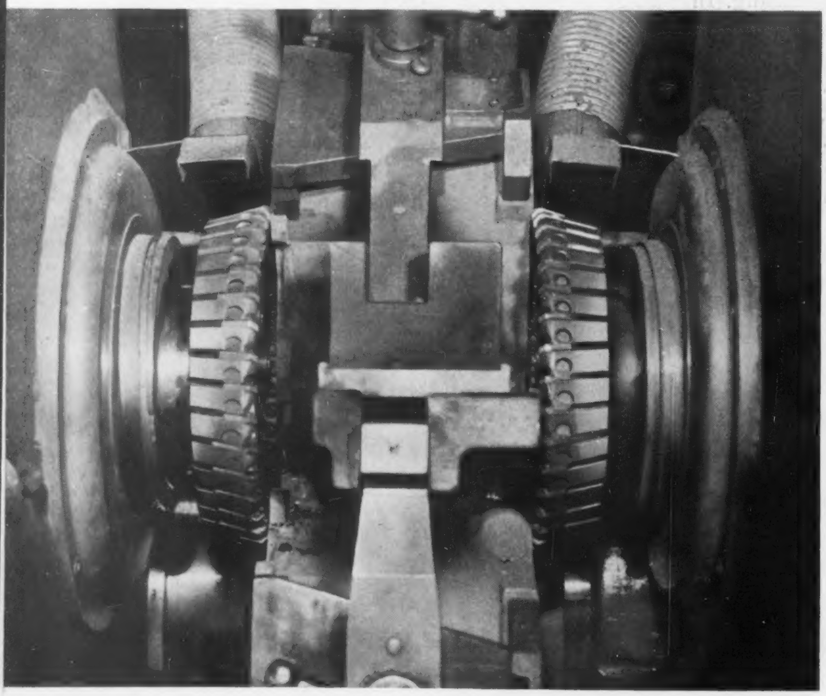


Fig. 2. Two of the four 12-inch diameter face mills with solid carbide inserts employed in the straddle-milling of automotive transmission cases. Roughing by two cutters and finishing by two additional cutters are accomplished in the same set-up.

use than any conventional single-point carbide lathe tool. With the milling cutter, as with the single-point lathe tool, metal is being cut and chips are being formed by the action of a carbide cutting edge supported by an adequate steel shank or cutter body. Of these two materials, the carbide is the most important and demands a fundamental understanding of its properties as a metal-cutting agent.

As a result of the materials involved in the creation of carbides and somewhat as a result of their method of manufacture, they possess some unusual characteristics with respect to the heat and pressures exerted upon them during cutting operations. Superior wear resistance qualities, combined with a high degree of red hardness and an extremely favorable compressive strength rating, place carbides high on the list of desirable cutting materials. A low rate of heat conductivity and a relatively low rate of thermal expansion, compared to that of steel, are characteristic of carbide. Also characteristic of this material are its strength factors. It has been found that carbide, by nature of its mechanical composition, generally has two or three times greater resistance to compressive loads than it has to bending loads. Recognition of these factors simplifies the design or selection of efficient cutter styles.

Long-Range Economy of Carbide Cutters

It is becoming more and more noticeable, as greater economical pressures are felt, that there is a vast difference between initial tool price and final tool cost. The tool design features that greatly affect carbide milling cutter performance may be made more readily apparent by reference to a standard single-point lathe tool. A single-point brazed tool has certain obvious advantages such as industrial standard design, low initial cost, ease of modification, simplicity of manufacture, and availability from suppliers' stocks. On the other hand, reconditioning of this type of carbide-tipped tool creates excessive indirect costs due to the complexity of simultaneously grinding two such radically different materials as the carbide tip and its supporting steel shank. Mention of these points is important because the same cost factors that apply in the case of single-point tools are so often representative of those encountered with the wide variety of carbide milling cutters offered to the potential user.

Some of the undesirable qualities of brazed carbide tools have been overcome by tool designs in which the carbide cutting member is mechanically retained. Simple, yet effective, tool-cost study systems practiced by many modern industrial plants have provided adequate testimony as to the low operating cost resulting from the use of mechanically held solid-carbide cutting edges. Aside from the elimination of many chipped and cracked carbide tips, they often furnish improved performance by permitting the use of harder carbide grades than would be permissible if brazing were required. Another valuable feature is the ability to change the tip instead of the complete tool when regrinding is necessary or when a change of grade is desired.

Carbide Milling Cutters Compared to Single-Point Tools

Since a carbide milling cutter is basically a rotating group of single-point tools, certain comparisons between the two can be made. A "fly cutter" can be nothing more than a single-point lathe tool firmly supported in some type of rotating body. Due to the combined action of a rotating cutting edge and a moving work-piece, a flat surface can be generated by successive sweeps of the cutter in its plane of rotation. If the supporting steel body for this single cutting edge is enlarged to the point where additional cutting edges can be inserted in its periphery, we have the creation of "step mills" or "odd-job cutters," such as those illustrated in Fig. 4.

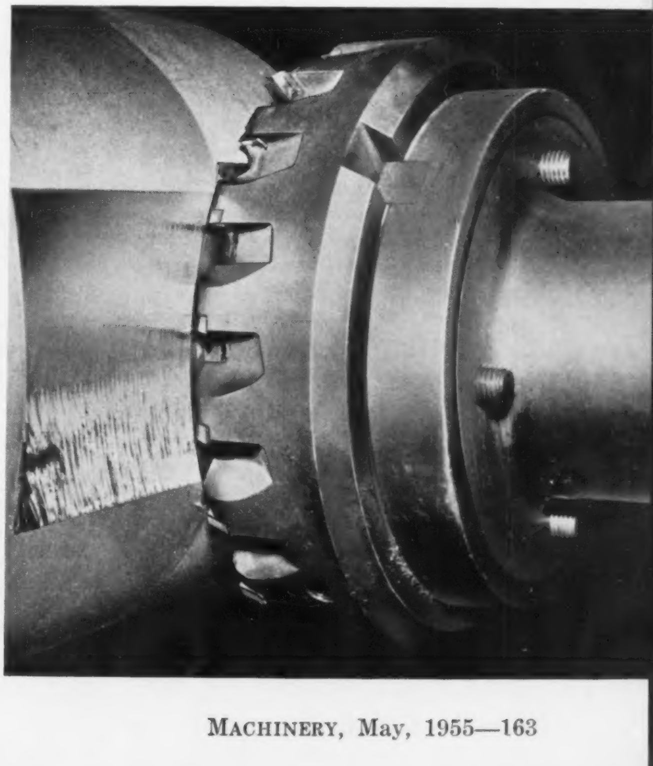


Fig. 3. Milling flats on alloy-steel roll journals. A 7/16-inch deep cut is being taken at a spindle speed of 100 R.P.M. and at a feed rate of 10 inches per minute. The twenty-tooth cutter being used is 12 inches in diameter.

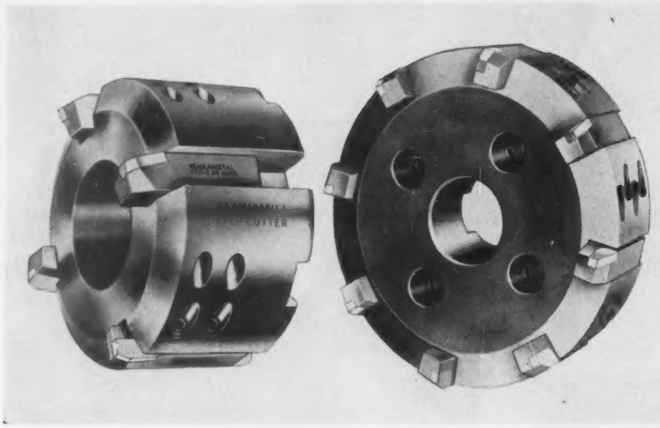


Fig. 4. Cutter blades in the step mill, left, may be set at different levels to divide the total depth of cut into several steps. The odd-job cutter, right, is used for deep or complex cuts.

The step mill is actually a multiple-blade fly cutter containing carbide-tipped single-point tools. These are held in a steel body by set-screws, and adjusted axially to divide the total depth of cut either into four uniform steps, or into three uniform steps with the last blade positioned to take a light finishing cut. This is an extremely versatile cutter for small shops, and an efficient job-lot cutter for large shops. The blades of this cutter are ground singly on any conventional carbide tool grinder, then checked with a template and set by hand to the required depths by means of a scale or a stepped block, or else by utilizing the milling machine feed-screw. When work-pieces having extremely rough, sandy, or scaly surfaces are to be machined, and when ease of blade grinding is an important consideration, tool maintenance is minimized since only the roughing blade is subject to highly abrasive action. A step mill is shown being used to mill tool shanks in the heading illustration.

The odd-job cutter is also a universal type tool for job-shop types of production. It is available for mounting on either standard spindles or C-arbors and utilizes a single size of blade to fit all sizes of both types. This cutter is intended primarily for jobs involving greater depth or complexity of cut than can be made with other styles of face mills. For such jobs, specially formed carbide-tipped blades are so placed in the slots of the cutter body as to divide the milled area into a series of overlapping cuts, Fig. 5.

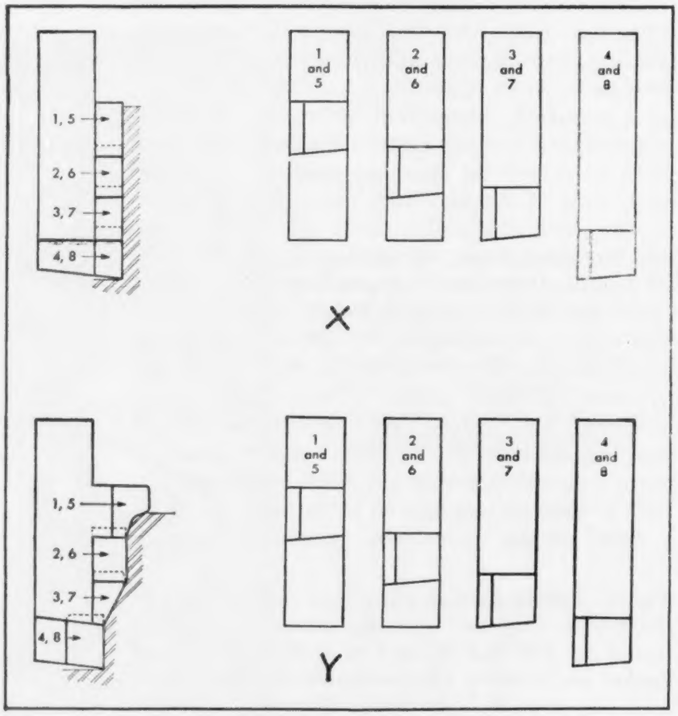
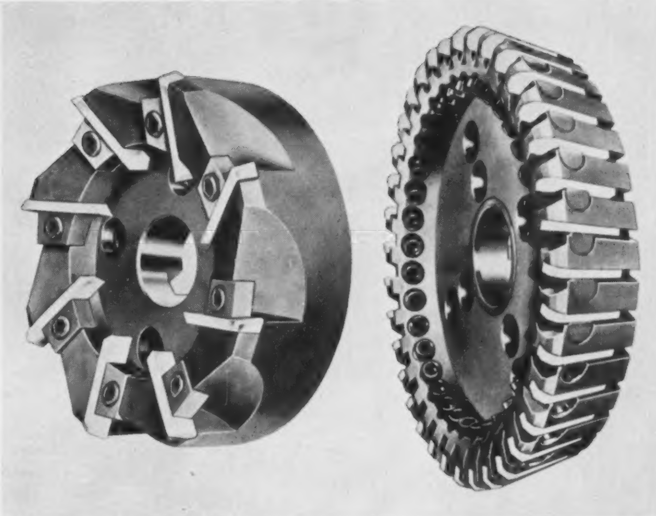


Fig. 5. Special inserts for odd-job cutters are shown diagrammatically. The arrangement at X permits milling a deep cut to a square shoulder. The layout at Y is designed for milling a form cut in one pass.

Fig. 6. Mechanically held carbide blades have proved advantageous as compared to brazed carbide-tipped inserts. This type cutter not only provides a high metal removal rate, but also greatly simplifies regrinding of the blades.



When set up in this way, a side-cutting tool is formed.

At X in Fig. 5 is a diagram of the cutter arrangement on an 8-inch diameter odd-job face mill used to machine a straight cut to a square shoulder 2 1/4 inches deep. The cutter body contains two sets of four different blades having various positions axially, but protruding the same distance radially. These blades make overlapping cuts, as shown at the left, the numbers representing blade slots in the cutter body.

Milling an integrated form cut with an 8-inch diameter odd-job face mill is shown diagrammatically at Y, Fig. 5. The cutter contains two sets of four specially ground blades. Although these cutters are also arranged in different positions axially, they protrude different distances radially as well.

Emphasis should be placed on carbide milling cutters designed with features similar to those found in the mechanically held type of single-point lathe tools. Comparison of the three cutter types already mentioned with the remaining two popular types, as illustrated in Fig. 6, makes it apparent that the mechanically held blade designs offer important factors of performance and low-cost operation. Although these face-milling cutters are designed essentially for use on steel, they can also be used on other materials. One style of this type cutter is shown taking a big bite in a rectangular block of alloy-steel plate stock in Fig. 7.

Detachable blades of solid carbide are securely wedged into a precision-built, heat-treated body that is set at fixed axial and radial angles, and has a narrow land ground on the working edge. By varying the land and clearance angles on blades of the proper carbide grade, the cutter can be adapted for the efficient milling of different materials. Distinctive operating characteristics of this type of cutter are low power required to form and eject chips; high rate of metal removal; cool work and cutter, the heat of cutting being confined to the chips; and good surface finish, even on deep cuts and at heavy chip loads.

Available shop facilities must be considered in regard to methods of regrinding the carbide milling cutters. Their design, in many cases, permits jig grinding the individual blades on a simple surface grinder, Fig. 8. Even in shops having adequate facilities for grinding carbide milling cutters while assembled, it has proved advantageous to have cutter blades that can be individually resharpened at the convenience of tool-room personnel according to the type of equipment available at any particular time.

One of the biggest cost-saving factors realized by shops using cutters with mechanically held solid-carbide blades is the reduction in grinding wheel replacement. As in the case of single-point tools, numerous cost studies of grinding wheel life have proved that wheel costs, when grinding carbide alone, are usually one-third of the wheel costs experienced when a combination of steel and carbide must be ground together. The complete floor-to-floor cycle of regrinding a 14-inch diameter cutter with fourteen solid type blades can be accomplished in less than forty-five minutes under ordinary conditions.

Role of the Milling Machine, Work-Piece, and Operator

The second important factor in the formula for profitable carbide milling involves the milling machine itself. Once the appropriate cutter for the job has been selected, it must be determined whether the machine will provide adequate power

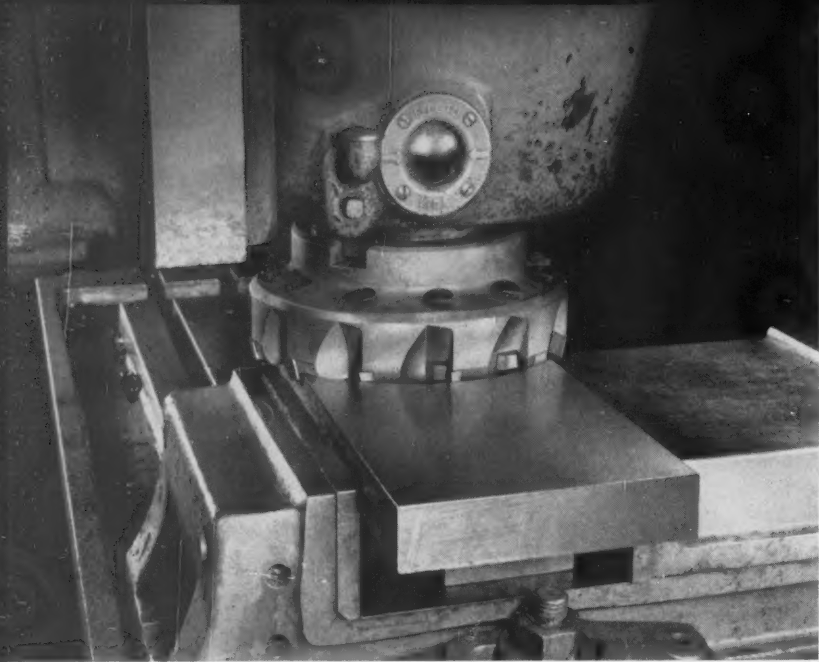


Fig. 7. (Left) An 8-inch diameter face mill having solid carbide blades is mounted on the spindle of a vertical milling machine. A deep cut is being taken across the face of hot-rolled alloy-steel plate.

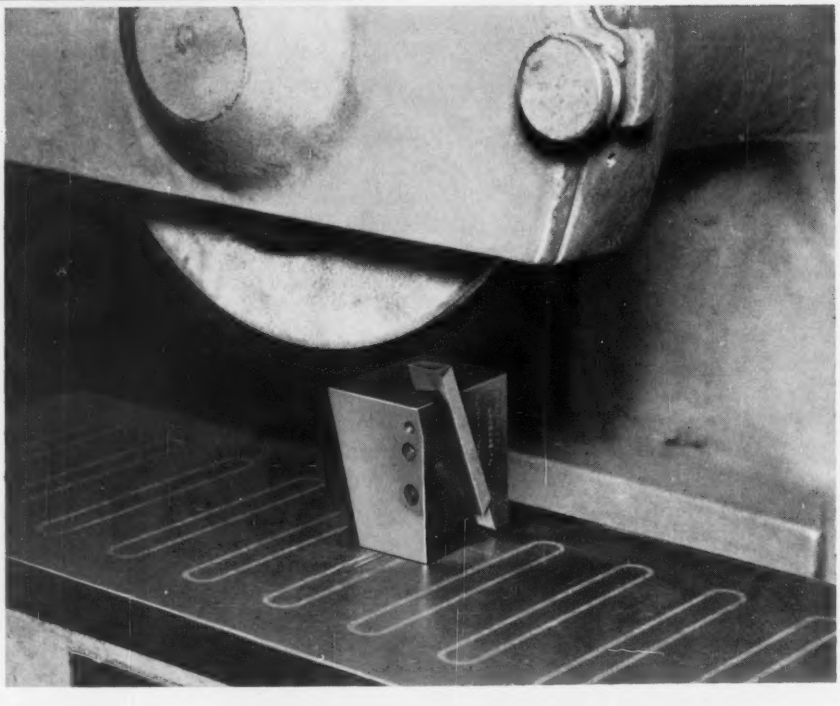


Fig. 8. (Right) Solid carbide blades may be ground on a conventional surface grinding machine. Peripheral relief is being ground on one such blade while it is held in a special fixture on a magnetic chuck.

to permit the desired rate of metal removal from the work-piece. This power requirement question also includes the ability of the machine to rigidly support the work-piece in relation to the cutter.

Not to be overlooked in analyzing the vital factors pertaining to the milling machine and its influence on profitable cutter operation, are the requirements of speed and feed capacity. Cutter spindle and table feed mechanisms must be able to withstand the continuous pressures involved during the efficient use of the available horsepower and carbide milling cutter.

The third element that demands attention is the work-piece itself. Work-piece machinability, as it pertains to milling, should be given the same consideration that it would be accorded in the case of lathe turning. The amount of material to be removed, together with any design features of the work-piece that may influence cutter operation, must be considered. Surface condition is important: Is it free cutting or is there a hard scale? is the cut continuous or interrupted? is the depth of cut constant? are there sand inclusions or any other irregular cutting features?

Also to be considered is the ability of the work-piece to withstand the cutting pressures normal to the speeds and feeds to be used with the car-

bide milling cutter. Adequate support is essential. If the work-piece design does not provide the desired rigidity, then additional support must be built into the holding fixture.

The last, and probably the most important factor in the formula for profitable use of carbide milling cutters is the machine operator. It has been demonstrated that the basic instruction and knowledge required by the operator are not unusual for average production personnel. However, adequate instruction on the part of production supervision is needed to combine all four formula factors into a single, smooth-working procedure.

The operator has to understand why and how he is expected to obtain the desired production rates together with the required dimensional and finish factors. He must have a basic understanding of carbide grades and carbide milling cutter design features, as previously outlined in this article. Important points of the machine and the work-piece having a direct influence on the end result must also be known. In summation, it may be stated that the operator's ability to recognize the necessary factors of cutter, machine, and work-piece, in addition to his ability to combine them in proper relationship to each other, is the key to profitable milling with carbide.

Further information pertaining to machine set-up and operation with carbide milling cutters will be presented in the concluding installment of this article.

Tape-Controlled Precision Boring Machine

THE punched-tape principle of automatic operation has been applied to a precision machine used in boring shaft holes in instrument gear-train plates. A system devised by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., functions around a standard four-spindle Ex-Cell-O precision boring machine that has been modified with built-in electronic controls.

Hole coordinates and feed instructions are punched on the tape by a perforating machine similar to a typewriter. Electronic signals from the tape regulate the linear travel of the machine's hydraulic cross-slide and the rotary motion of a special holding fixture mounted on the cross-slide. Tape preparation requires approximately five minutes per hole, and complete change-over from one part to another can be accomplished in approximately thirty minutes.

To utilize automatic operation, the punched tape is placed in the "reader" unit of the control circuit. After inserting a work-piece in the fixture, the operator merely presses a button to initiate the automatic tape-controlled cycle. After the machine has "read" the complete strip of tape, it automatically stops to permit removal of the finished part.

When only a small number of parts are needed, the machine can be operated manually. In either manual or tape-controlled operation, coordinate information is fed to the machine in increments of 0.0001 inch over the available 8-inch linear range, and in increments of 0.01 degree over the 360-degree rotary range. Accuracy is claimed to be better than plus or minus 0.0005 inch.

Using a machine similar to a typewriter, the operator (foreground) is punching hole coordinates and feed instructions on tape. This tape will be used to automatically operate the modified four-spindle precision boring machine (background).

Light Hydraulic Presses Do Fast Precision Work

One press, with indexing dial, applies hollow pins to assembly and stakes ends. Another, pierces, forms, and cuts off stainless-steel strip and spot-welds it to washers

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EFFECTIVE and excellent use is made of many Denison Multipresses for various metal-working operations in the Endicott, N. Y., plant of International Business Machines Corporation. One of the most interesting set-ups on these light hydraulic presses is shown in Fig. 1. It involves the use of a six-station indexing dial which has one station directly under the press ram.

In this set-up, almost completely automatic, hollow pins for wire contact relays are assembled to molded plastic bases. Two pins are inserted in each molding, then staked at one end by punches to effect a permanent fastening.

To do the job properly, and at a rapid rate, the pins are placed in a hopper, operated by a Syntron electric vibrator, and are fed from this hopper down tracks into two magazines. Six simple work fixtures, each having two clearance holes to receive the two pins, are radially located on the dial and register at the six stations. With every indexing to a pin-loading station, a pin from each magazine feeds into one of the holes, which leaves uppermost the end to be staked. An air-actuated slide synchronized with the indexing permits only one pin at a time to feed from each magazine. A flange at a point along the pin body keeps all pins entering the tracks in the same direction.

The next indexing brings the fixture to a station where the plastic bases are loaded manually. Here, the worker takes a part from an adjacent

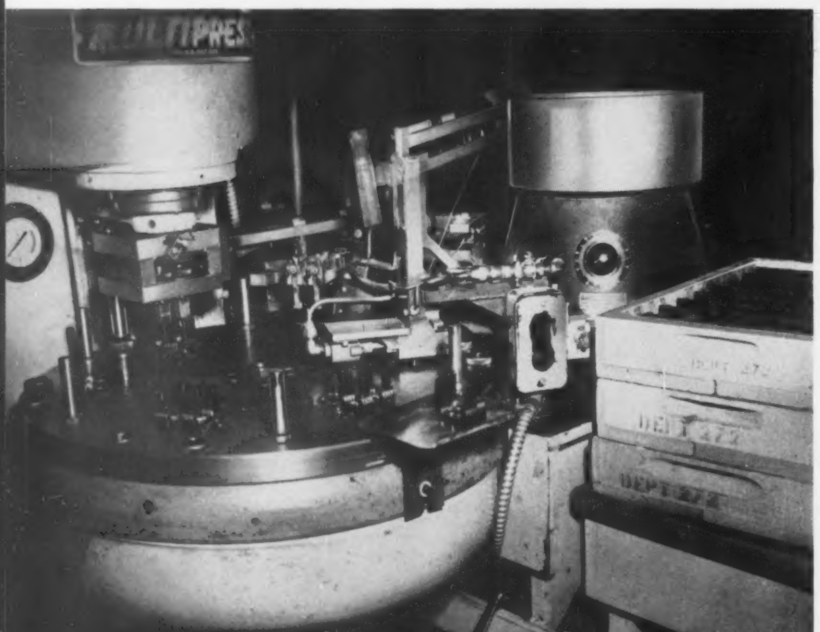


Fig. 1. The stroke of this hydraulic press secures the assembly by staking the upper ends of two hollow pins.

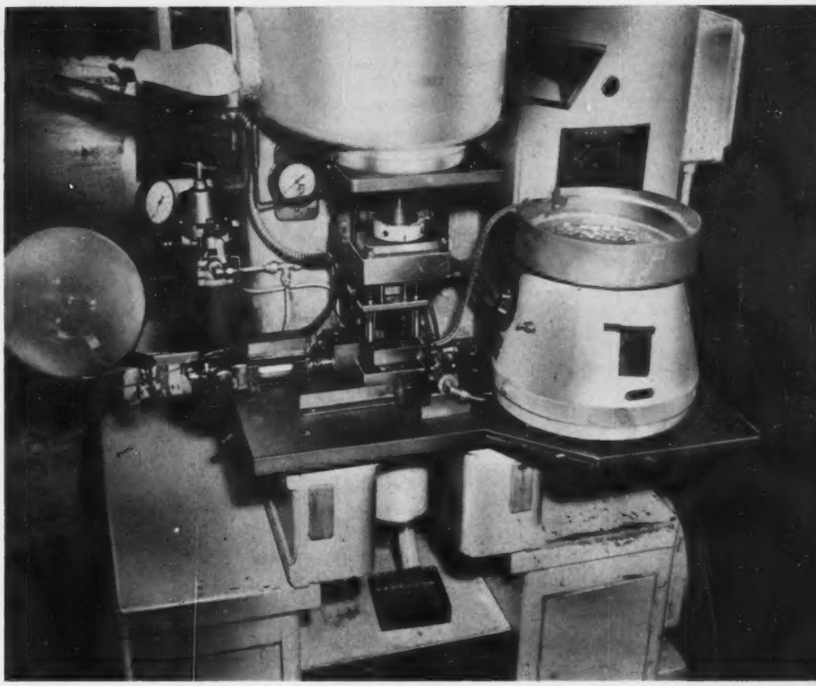


Fig. 2. Here, the stroke of the press is utilized to pierce, form and cut off the strip, as well as to actuate two spot-welding electrodes.

tote box, slips it over the two hollow pins already in the fixture, then presses it down against the fixture face and pin flanges. Previously the bases have been stacked with a washer, a rubber bumper, and a stainless-steel guard. Subsequent indexings of the dial carry each loaded fixture to two idle stations and then to the press station.

In an automatic cycle at the press station, two punches stake the upper ends of the pins, securing the assembly. At the next and last station, the prongs of a pick-up arm grip the sides of the assembly, and elevate it pneumatically so that the pins disengage the fixture holes. Then the arm is swung horizontally through an arc until the assembly clears the dial. This motion causes wedges to release the prongs, and the work drops into a chute. Impelled by air jets, it slides into a tote box, completing the cycle.

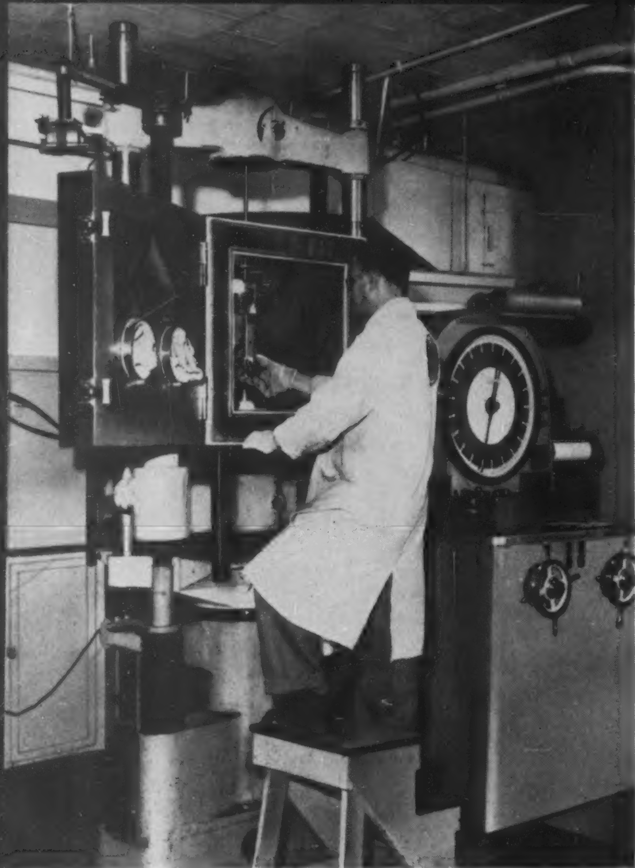
In this set-up, indexing occurs 2000 times an hour and, if the worker keeps pace with his hand loading, which he can do easily, 2000 assemblies an hour are obtained. Safety factors are high because the press station is at a distance from the worker and his hands are kept well away from the punches as well as from the moving elements at other stations. If a station is skipped or incorrect loading should result, no damage occurs. Thus, assembly is rapid, precise, and safe.

Equally impressive and even faster is another set-up illustrated in Fig. 2, which shows the forming and the welding of a small stainless-steel flat spring to a 5/16-inch square steel washer. The spring is 0.0035 inch thick, 9/32 inch wide, and 7/16 inch long. It has to be formed with a 6-degree transverse bend near each end, and pierced with a 7/32-inch hole; then two tiny spot-welds are made to fasten the spring to the washer, with the hole in the spring concentric with the one in the washer.

In spite of the small size of this assembly and the precise operations performed, 70,000 are produced per eight-hour shift, or an average exceeding 145 per minute. Washers are produced and plated in separate operations, and are fed automatically from a track magazine extending from a hopper equipped with a vibrator. Around the inside of the hopper are steps on which the washers advance in a spiral path.

The press operates two punches; one pierces a hole in each length of spring, and the other forms the spring against a die. In addition, the press operates two welding electrodes, and a knife which shears the spring from a reel of ribbon stock. There are two separate, pneumatically actuated transverse slides timed to the press cycle. One slide feeds the ribbon, and the other slide picks up a washer from the magazine and advances it positively into the correct position for welding.

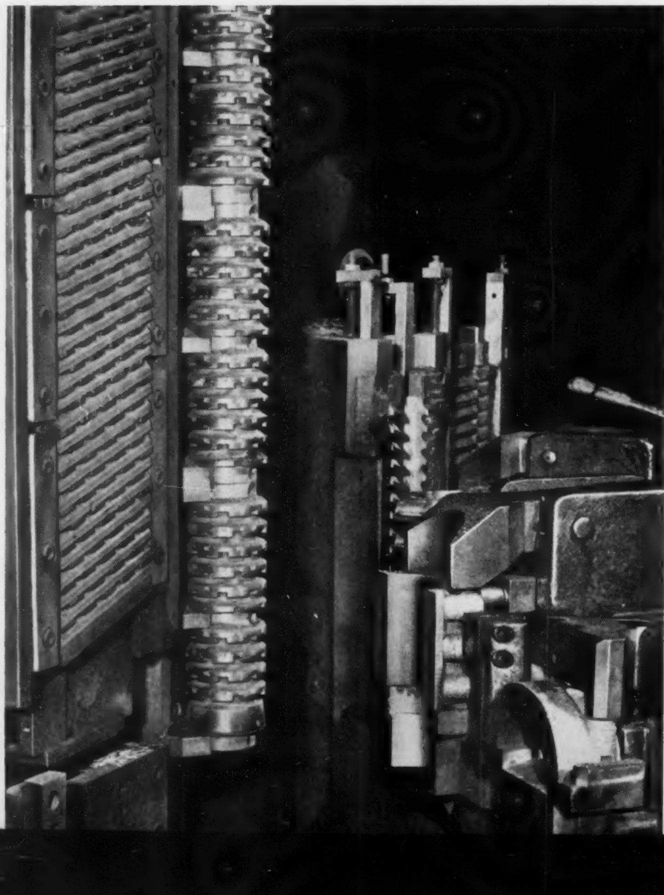
A General Electric welder provides the current for the spot-welds produced when the tiny electrodes press the spring against the washer. The electrodes are moved downward until they contact the ribbon, and then are kept under spring pressure until retracted when the press executes its up stroke.



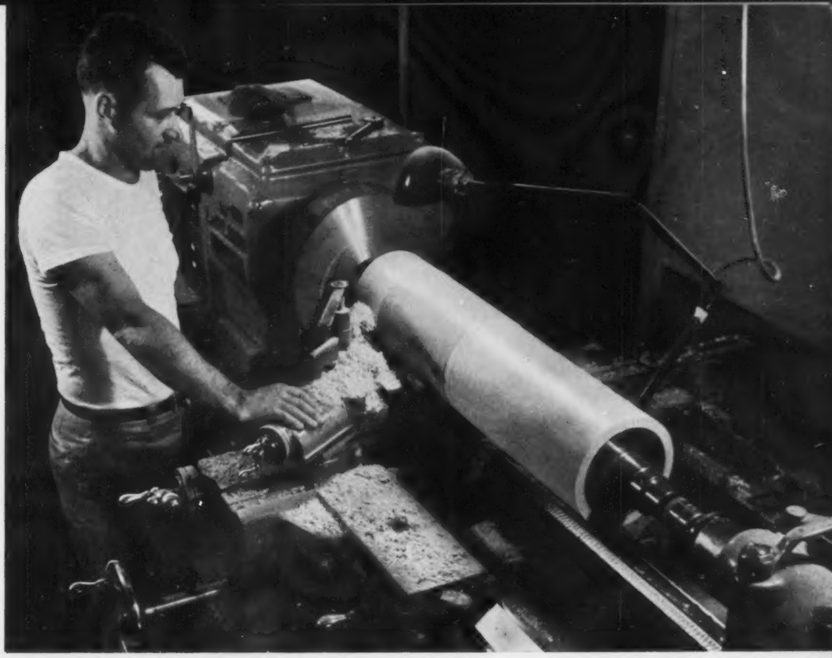
In Shops Around the Country

Camera highlights of some interesting operations performed in various metal-working plants throughout the nation

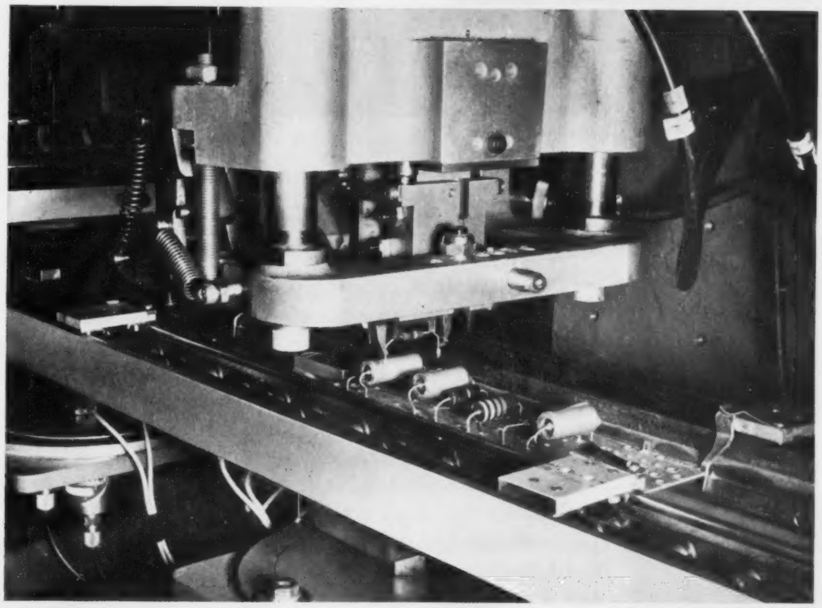
Testing temperatures ranging from 400 degrees F. down to minus 100 degrees F. are obtainable in this controlled-temperature portable cabinet at Glenn L. Martin Co., Baltimore, Md. In the door of this cabinet, designed by Baldwin-Lima-Hamilton Corporation, are two heat-insulated hand-holes and a window to permit outside manipulation of accessories within the unit.



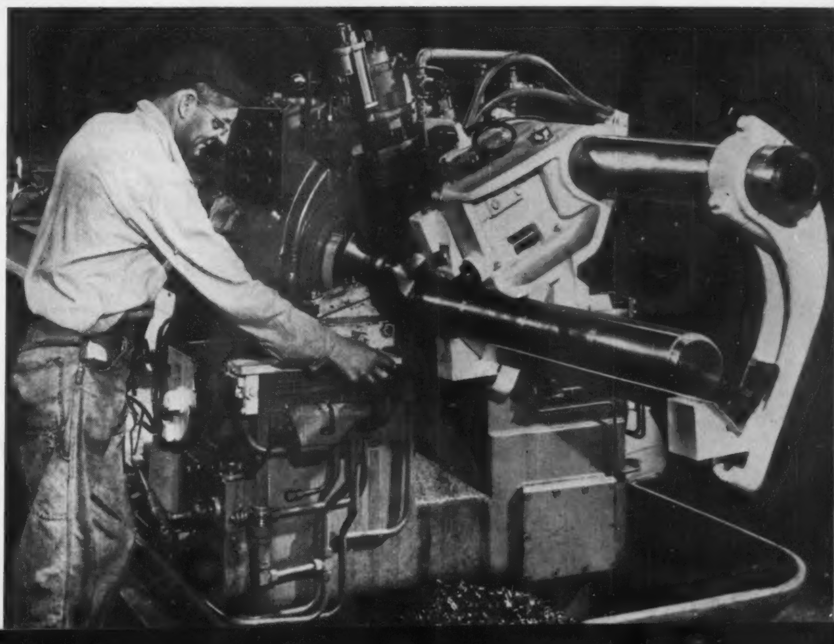
Broaching automobile bearing caps at Studebaker-Packard Corporation, South Bend, Ind. Work is done on a Cincinnati vertical broaching machine, having two rams, at a speed of 28 surface feet per minute with a chip load per tooth of 0.005-inch for roughing and 0.0015-inch for finishing. The cutting tips are Carboloy Grade 883.



Finish-turning steel rolls that have been recovered with laminated thermosetting plastic at Synthane Corporation, Oaks, Pa. Prior to this operation, the metal rolls were hot-wrapped with a resin-impregnated fabric, oven-cured at a temperature of 300 degrees F. to insure complete polymerization of the wound layer, and then trimmed.



A small resistor is being automatically inserted into a plastic printed circuit plate at International Business Machines Corporation. On this "Autofab," built by the Mechanical Division of General Mills, Inc., the circuit plates are advanced on a conveyor, halting momentarily under each of twenty-four heads for inserting an electronic part.



Hot-rolled rounds are being cut into billets at Jones & Laughlin Steel Corporation, Pittsburgh, Pa. The billets, which are 5 inches in diameter and 10 inches long, are being cut on a Bardons & Oliver automatic cut-off lathe. Following this, they will be induction heated, coated with powdered glass as a lubricant, then rammed through an extrusion die.

Etched Dials for Monarch Lathes

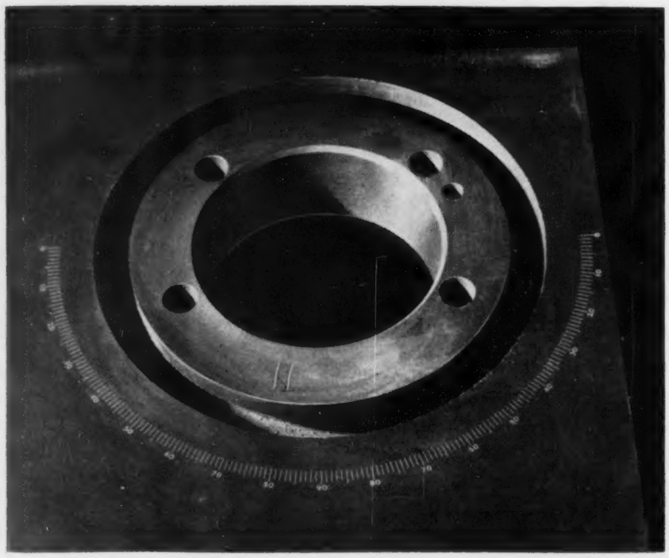


Fig. 1. Visible and accurate, this is one of two semicircular protractor dials for a right-angle lathe that are obtained by a nitric acid etch.

Fig. 2. With the casting placed on a work-table, the first step is to position a register frame by means of thumb-screws.

SILK-SCREEN photographic etching plays a useful role in manufacturing right-angle lathes at the Monarch Machine Tool Co., Sidney, Ohio. The process is used to produce the semi-circular protractor dials in top surfaces of the carriage and the air-tracer slide. Since these are bearing surfaces, the dials cannot be applied externally. Accurate pivoting of the slide and the tool compound depends on the fineness and visibility of the dial calibrations.

In considering the best method for producing the dials, pressing and rolling were both ruled out. Neither possessed sufficient fidelity of reproduction over the large work area—the dials having a diameter of 13 inches. Three experimental milling set-ups had required seventeen hours of machining time each and had still eluded the close tolerances specified.

Exploring the possibility of etching the dials, Monarch turned to its source for equipment nameplates, Sidney News Engravers, Inc. This company tried various photographic methods, all of which had to be abandoned. Then success came when the Kodak Ektagraph process was applied.

A silk-screen stencil of the dial in reverse was made with Ektagraph film. The pattern was

Fig. 3. The silk-screen stencil of the dial in reverse, made with Ektagraph film, is taped to the window of the register frame.

transferred to the work with a squeegee, using Dolfinite silk-screen green enamel. A second color of enamel was brushed around the outside as a dam, and permitted to harden overnight. Then, a 1 to 3 etching solution of nitric acid was added for a controlled time of a minute and a quarter, the resist removed, and the job was done.

Because of the photographic reproduction, there was no distortion or variance in any of the markings on the scale. The cost to Monarch, about $10 per piece, was insignificant compared to that for the unsatisfactory milling. With the practicality of the Ektagraph process firmly established, the operation has been shifted from the engraver's shop to the Monarch plant, chiefly because of the inconvenience in transporting the 265-pound carriage castings.

Castings are handled in lots of fourteen. A wooden register frame fastened in turn to each casting is fitted with a hinged window to which the film stencil is attached. With the window lowered over the work, the squeegee and other operations follow, as previously described. Each lot requires only 8 ounces of acid solution. The etching is fastest and most satisfactory when shop temperature is about 75 degrees F.

Fig. 4. After the window is lowered, enamel is applied by squeegee. Later, a 1 to 3 etching solution of nitric acid is added.

Chevrolet V-8 Engines Made on "Production Line of Tomorrow"

Advanced design machine tools and "segmented automation" are outstanding features of the new production facilities used to manufacture Turbo-Fire V-8 automotive engines. The completed plant will have a capacity of 280 engines per hour

By J. D. Greenough, Master Mechanic
Van Slyke Road Engine Plant
Chevrolet Motor Division
General Motors Corporation, Flint, Mich.

CHEVROLET's new Turbo-Fire V-8 engines are being produced with advanced design machinery installed in a modern, 1,000,000 square-foot factory on Van Slyke Road in Flint, Mich. When all of the equipment has been installed, the plant will be capable of turning out 280 engines per hour. In addition to the latest type machinery and tooling, outstanding features of the new production facilities include unique automatic material-handling set-ups and one of the first applications of "segmented automation."

When using segmented automation, multiple-station transfer machines are located at intervals along the production lines, with space provided between successive machines for storing partially completed work-pieces should the next machine be inoperative for any reason. With the former method of connecting the loading end of one machine directly to the unloading end of the preceding one, a complete halt in the entire production was necessary when any machine had to be shut down for required repairs, tool changes, or maintenance.

Now, the reserve bank of partially finished engine parts stored between any two adjoining machines can be used to continue the production when the preceding machine is shut down. Also, the banks of parts provided along parallel duplicate lines required to attain the necessary production are interconnected by cross conveyors for increased flexibility. Unfinished parts can thus be shifted from one line to another to minimize any loss of production. Meanwhile, the part of the production line preceding any idle machine can be operated to stockpile more partly finished work-pieces. When the trouble has been

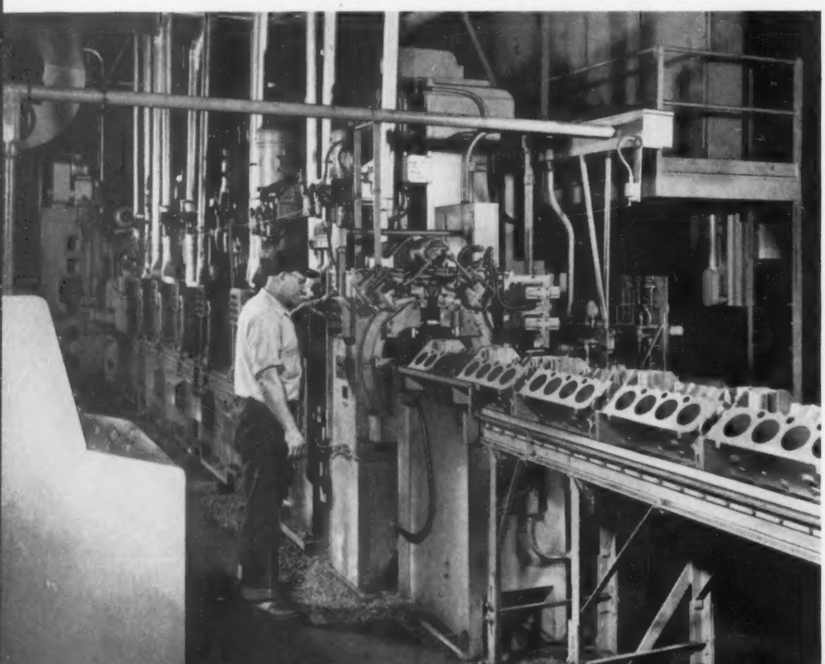


Fig. 1. Miscellaneous holes in V-8 engine block are drilled and various surfaces are milled on this thirteen-station transfer machine.

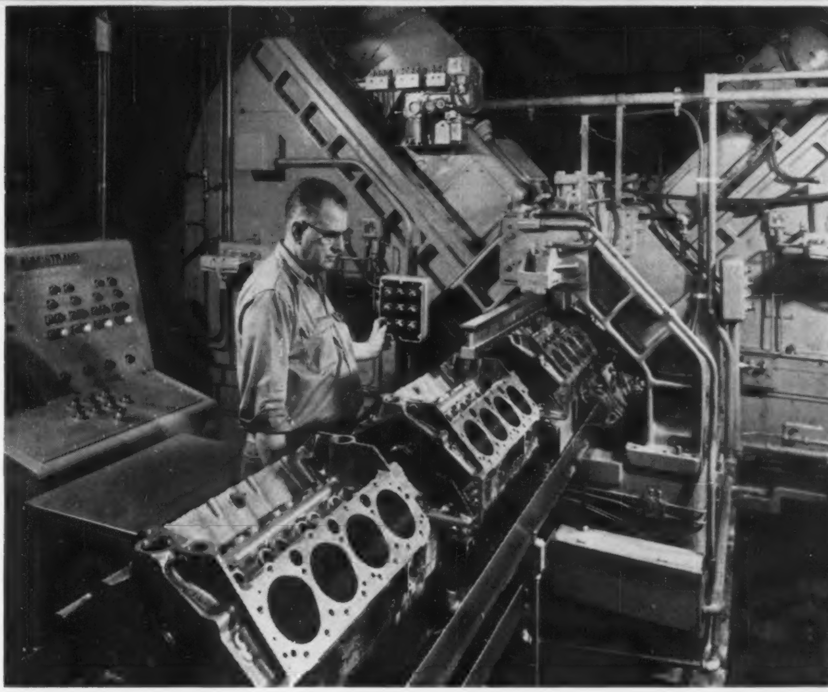


Fig. 2. Heat is dissipated more rapidly and less distortion of the block results from rough-machining alternate cylinder bores two at a time on this machine.

corrected or the defective tools replaced on the idle machine, this machine can be returned to automatic operation in sequence with the others in the production line.

A comprehensive preventive maintenance program is provided for the new engine plant, with lubrication and other maintenance of transfer and similar machines being performed at fixed intervals. Tool control boards are used with most machines to store sharp, pre-set tools. The boards have timing devices to indicate when the tools should be changed. An IBM system has been provided—using punched cards for tabulating information such as machine down time and tool life for various operations—to improve production and maintenance.

Air in the plant is changed every twelve minutes. Under-floor conveyors extending the full length of the production lines carry chips to a main conveyor (running at right angles to the other conveyors) which lifts the chips overhead and dumps them into railroad cars. Also, overhead collectors are provided to remove cast-iron dust and transfer it to Centri-Spray units for filtering and washing. Steel chips are collected in settling tanks, where cutting fluids are extracted. Then, the chips are crushed and loaded into railroad cars. Central coolant systems for the various machines are located in a separate building outside the main plant.

When all machines and equipment have been installed, the plant will have four automated engine block production lines, six head lines, and two final assembly lines. The balance of the forty-seven engine parts being manufactured are, in general, produced by methods that have been proved satisfactory in making Chevrolet six-cylinder engines.

The engine block production lines are U-shaped, each leg being 560 feet long. Cast-iron blocks, each weighing about 190 pounds, are first fed to a Cincinnati two-way, horizontal broaching machine. Here, the pan rail, half-round crankshaft bearing surfaces, lock grooves, both bank surfaces, and the top of the casting are broached. Some of these surfaces are broached as the ram moves in one direction, and the remainder, as the ram returns. The block is rotated 180 degrees and elevated by a hydraulically operated fixture located between two stations.

After broaching, the blocks automatically move through a straight line of nine transfer machines, 320 feet long, containing a total of 122 stations and 550 spindles. First, the broached castings enter a Sundstrand thirteen-station transfer machine, Fig. 1, containing forty-eight spindles. On this machine, two locating holes and the front bearing cap holes are drilled, chamfered, and reamed; and the rear main oil-hole, main dowel holes, and holes from the main to the cam bearing are drilled and reamed. Also, both sides of the main bearings are straddle-milled, and the fuel pump face, oil slinger, and seal grooves are milled. Gallery holes are air tested at the fourth station, and chips are dumped by turning the block over at Station 8.

A departure from conventional block manufacturing practice, and one that is credited with the high degree of accuracy and smooth performance of the engine, is the rough machining of the cylinder bores alternately, two at a time. This is done on the Sundstrand sixteen-station transfer machine seen in Fig. 2, which has eight idle stations. By machining only two bores in each block at a time, and with these bores separated by the alternate bores, there is less distor-

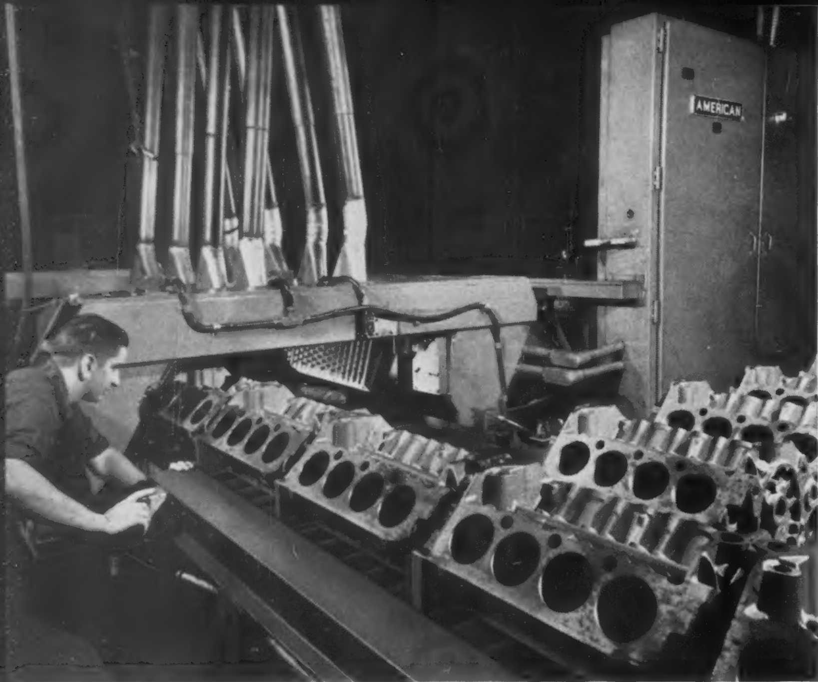


Fig. 3. (Left) Irregular contours on end surfaces of cast-iron V-8 engine blocks, having an average thickness of 1/4 inch, are broached in this set-up.

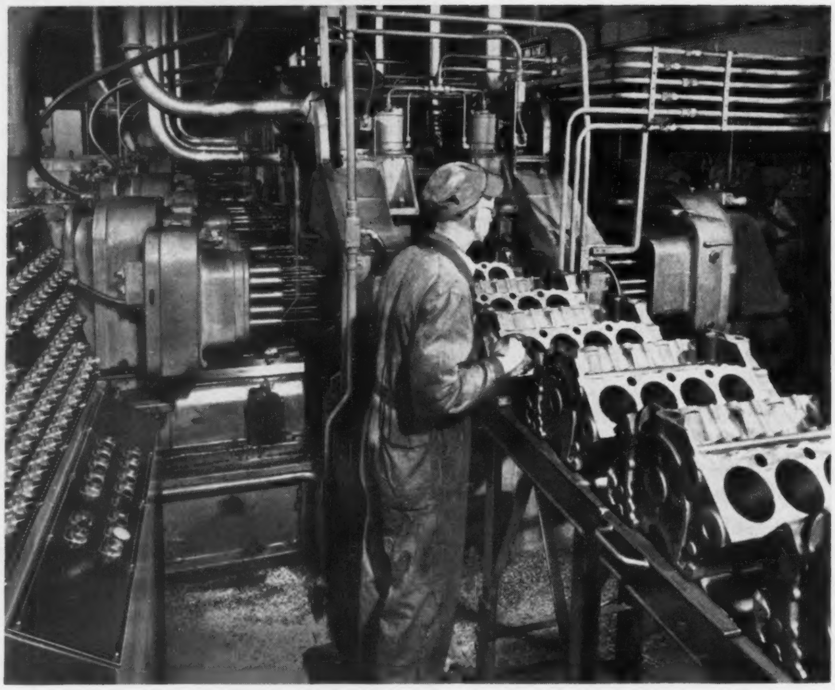


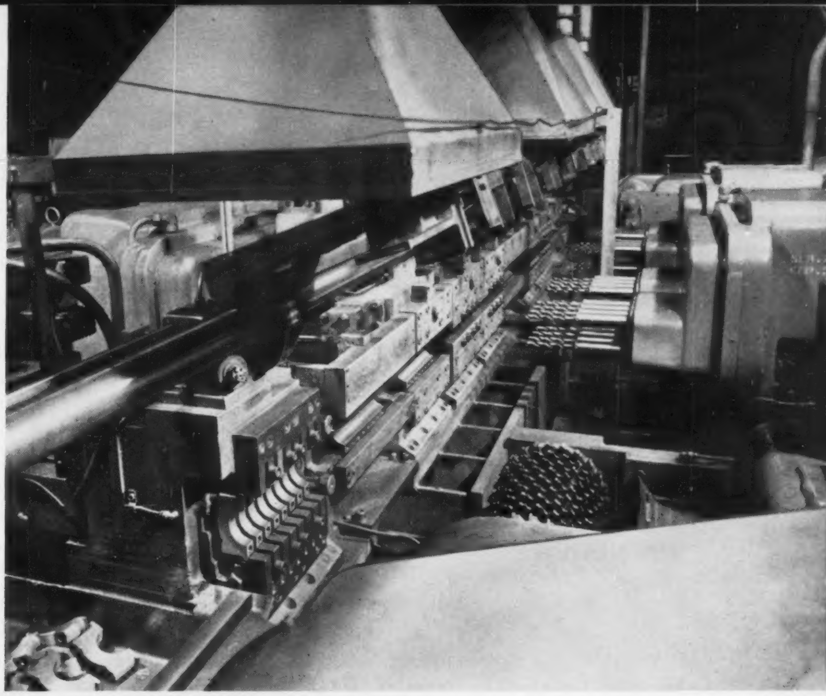
Fig. 4. (Right) Twenty-five-station transfer machine for drilling all holes in both ends of engine blocks, as well as drilling and reaming other holes.

tion and heating of the block. Also, a minimum of stresses are set up. In the same machine, the cylinder bores are chamfered four at a time.

Another innovation in engine block manufacture is broaching of the end surfaces. Since the surfaces have an irregular edge with an average thickness of only 1/4 inch, it was generally considered to be a difficult broaching operation. However, very satisfactory results are being obtained with the American horizontal broaching machine seen in Fig. 3. Castings are fed to the machine end-to-end, and are rotated 90 degrees in a horizontal plane before being broached.

A twenty-five-station transfer machine, Fig. 4, made by the W. F. & John Barnes Co., is then used to drill all holes in the front and rear ends of the casting. Also, on the same machine, the oil galleries and clutch housing dowel holes are reamed, the tappet cavity drains and breather-brace screw holes are drilled, the welch plug holes are drilled and reamed, and the cam holes are core-drilled. The machine has a total of 129 spindles, and seven stations have been left idle to take care of possible future changes in engine block design. Compressed air under a pressure of 70 pounds per square inch is used at Station

Fig. 5. (Right) Unloading end of fifteen-station transfer machine for milling, drilling, reaming, and chamfering caps. Caps are separated by gang cutters.



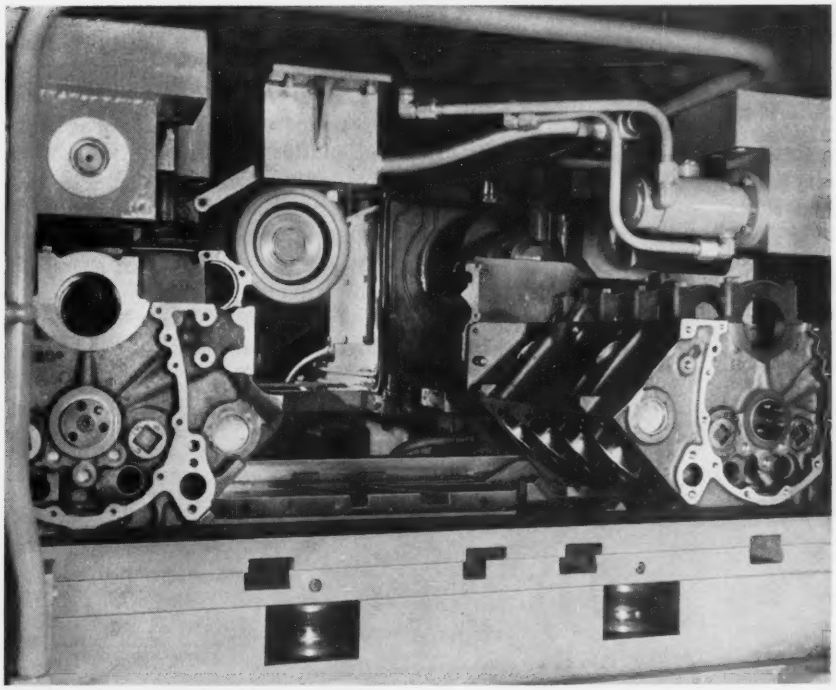


Fig. 6. (Left) Close-up view of a special transfer machine for boring and facing automatic transmission housings. A similar machine is used for standard transmission housings.

24 to check the three oil gallery holes for leaks. The castings are automatically unloaded from the machine at the twenty-fifth station.

All holes in the bank surfaces of the engine blocks are drilled, and chamfered where required; head dowel holes are reamed; tappet holes are spot-drilled and rough-reamed; and oil dip-stick and wire harness holes are drilled on a Greenlee eighteen-station transfer machine having 159 spindles. Then a Cross twenty-one-station transfer machine with 101 spindles is employed to drill, chamfer, or ream all the remaining holes in the bottom and sides of the blocks. These holes include oil, breather, fuel pump, and distributor post holes.

Another W. F. & John Barnes transfer machine, this one having thirteen stations and ninety-four spindles, taps all required holes in the engine blocks. During this operation, each block is automatically repositioned three times to present the desired surfaces to the tapping spindles. Tappet holes are semi-finish and finish-reamed on a Greenlee nine-station transfer machine, and the cylinder bores are semi-finish and finish-bored, four at a time, on a Sundstrand six-station transfer machine. On the latter machine,

the blocks are loaded two at a time, pan rail down, and are fed through the machine in pairs. One block is bored at Stations 2 and 3, while the other block is machined at the fourth and fifth stations.

This marks the end of a 560-foot long, straight production line (forming one leg of the entire U-shaped block line). At this point, the engine blocks are lifted, transferred, and lowered to the other leg of the U by an up-and-over automatic conveyor. Here the parts reverse their direction of movement, and travel parallel to the first leg, back to the area from which they started as rough castings.

Floor space is conserved, and the possibility of spindle deflection is eliminated, by honing the cylinder bores in a vertical position instead of at an angle, as has been conventional practice. Finishing of the bores is done four at a time on a Micromatic eight-spindle, vertical honing machine equipped with a special fixture for repositioning the block to place both bank surfaces up at succeeding stations. Sheffield multiple-column, Precisionaire inspection machines are used to check the diameters, out-of-roundness, taper, and bell-mouth of the cylinder bores, eight at a time. Also, the bores are classified and stamped for subsequent selective assembly with matching pistons, successive classifications varying from each other by only 0.0002 inch in bore diameter.

After washing the engine blocks, flushing out chips, and blowing dry, all water jacket plugs and front-end Dryseal thread plugs are automatically assembled by means of a special American Broach machine. Compressed air is then used to test for water jacket leaks. Blocks in which leaks are detected are immersed in water to locate the leaks.

Bearing caps for the V-8 engine are cast in clusters of eight, and the castings are milled, drilled, reamed, and chamfered on Cross fifteen-station transfer machines, each having fifty-one spindles. The unloading end of one of these machines is shown in Fig. 5, with the gang milling cutters employed to separate the bearing caps seen in the foreground. Rear main dowels and five main bearing caps are added to each engine block, and bolts are placed in the main bearing caps and tightened.

Engine blocks, with bearing caps assembled, are then loaded into an Ingersoll fourteen-station transfer machine having thirty spindles for semi-finish and finish-boring the cam and crank bores; finish-reaming, facing, and chamfering all the thrust bearings, and turning all the cam oil-grooves. Two automatic inspection and rejection stations are provided on this machine. Another special American Broach, seven-station transfer machine is used to assemble the cam bearings. The cam bearings, as well as the distributor post

Fig. 7. Two-way horizontal broaching machine cuts the contact faces, bosses, and locating notches on cast cylinder heads. Two heads are broached at a time.

Fig. 8. Twenty-station transfer machine for drilling, reaming, chamfering, and spot-facing various holes in cast-iron cylinder heads for V-8 engines.

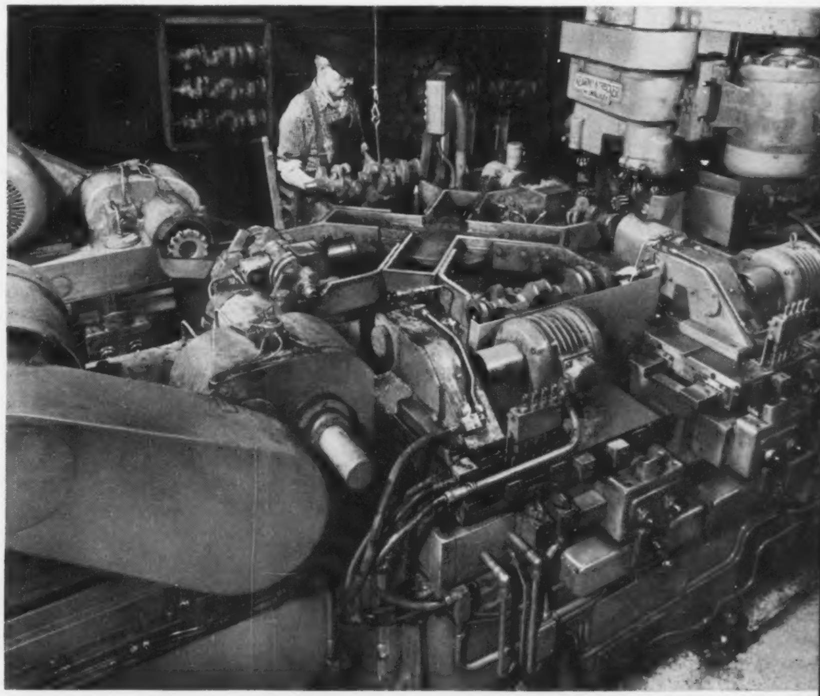
hole, are bored on an Ingersoll four-station transfer machine.

Bank surfaces on the blocks are finish-machined on a Cincinnati broaching machine. After again washing the blocks, the oil gallery plugs and camshaft and housing assemblies are attached. The bore and contour face of both Powerglide and standard transmission housings are machined on Kearney & Trecker special transfer machines. A close-up view of one of these machines is seen in Fig. 6. Block sub-assemblies are conveyed to either of two final assembly lines.

Cast-iron cylinder heads for the V-8 engines are machined on six production lines, three for left-hand and three for right-hand heads. Contact faces, bosses, and locating notches on the castings are cut on an American horizontal two-way broaching machine, Fig. 7. Two heads are broached at a time, the parts being located in the work-holding fixture from the cast combustion-chamber surfaces.

Broached heads are loaded into a Footburt twenty-station transfer machine, Fig. 8, having 157 spindles. Here, all holes except the valve

Fig. 9. Special four-station, rotary indexing machine for milling crankshafts to length, center-drilling both ends, and milling notches in cranks.



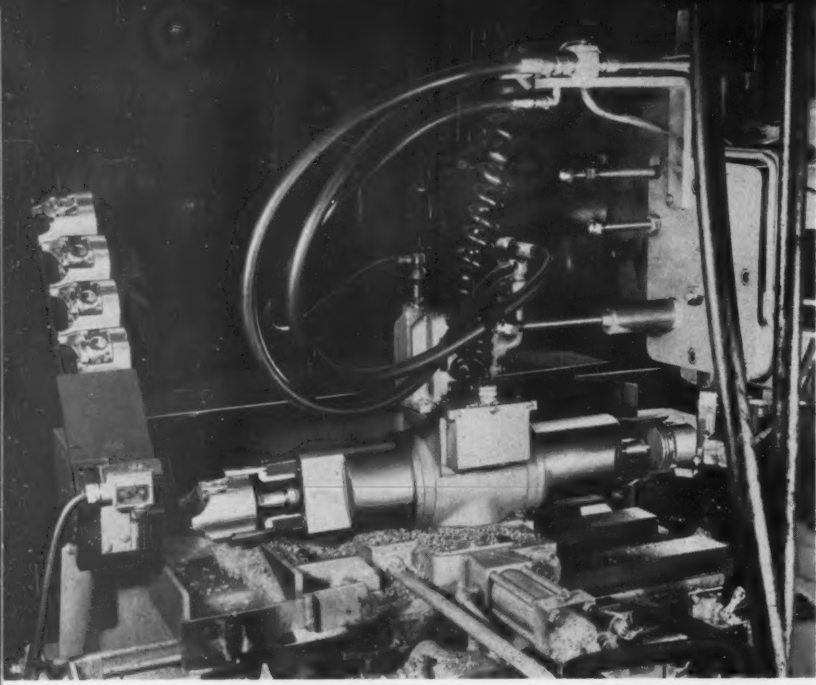


Fig. 10. Cast-aluminum pistons are automatically picked up one at a time from magazine at left and loaded into chuck of lathe by indexing fixture.

guide are drilled, reamed, chamfered, or spot-faced. At two stations, the heads are rotated to dump chips, and at Station 14, all holes that require subsequent tapping are checked for depth. A second Footburt transfer machine, this one having twenty-two stations and 108 spindles, is directly connected to the first. On this machine, the valve-guide holes are rough- and finish-machined, valve-spring posts and seats are milled, and all screw holes are tapped. The valve-guide holes are held to size within 0.0005 inch. At Stations 2, 12, and 19, the heads are automatically repositioned various degrees for additional machining, and at Stations 5, 8, 15, and 22, the heads are rotated to dump chips. After washing, drying, and inspecting the heads, valves and springs are assembled and the sub-assemblies are fed by conveyor to either of the two final assembly lines.

A special Kearney & Trecker four-station, rotary indexing machine, Fig. 9, is used to mill the V-8 engine crankshafts to length, center-drill both ends, and mill locating and driving notches in the cranks. At the first station, seen in the background, forged crankshafts are loaded and machined parts unloaded. When the forging has been indexed counter-clockwise to the second station, it is milled to length between two cutters, each 6 inches in diameter and having twenty blades. At the third station, both ends of the crankshaft are center-drilled. Three vertical, one angular, and two horizontal spindles are provided at the fourth station for milling the locating and driving notches in the forgings. Each spindle carries a milling cutter 3 inches in diameter and containing ten carbide blades.

Automatic loading and unloading have been provided on the Sundstrand lathes used to turn, face, groove, and chamfer the cast-aluminum pistons for the V-8 engine. As seen at the left in Fig. 10, pistons to be machined roll down a magazine attached to the tailstock end of the lathe. The pistons are picked up, one at a time, by loading fingers mounted on a double-arm indexing fixture. The fixture automatically indexes 180 degrees in a horizontal plane, and advances to load the piston in the lathe chuck.

Chucking is done on the cast bore of the piston, locating from the top and periphery of the part. A double-acting, aluminum, rotating air cylinder is used to actuate the chuck jaws through a draw rod. The piston is rotated at 2000 R.P.M., and cam-bar operated tool-blocks at the front, rear, and overhead are equipped with tungsten carbide-tipped tools for performing the various operations.

Rear tools are rapidly advanced, and then fed at the rate of 0.025 inch per revolution for facing. The feed rate is changed to 0.0067 inch per revolution for rough-grooving to a depth of 0.302 inch, and the tools are rapidly retracted. Meanwhile, tools mounted on the front of the lathe are cam fed at the rate of 0.030 inch per revolution for turning, then at 0.003 inch per revolution for finish-grooving. The overhead mounted tool is fed at 0.0105 inch per revolution for turning. A close-up view of the tooling area on one of these automatic piston lathes is shown in Fig. 11.

When machining has been completed, the piston is picked up by the loading fingers on one arm of the fixture as the chuck releases the part. After swinging the piston through 180 degrees, it is dropped into a disposal chute. Simultaneously, the loading fingers on the opposite arm of the fixture are placing an unmachined piston in the chuck of the lathe. In this operation, the

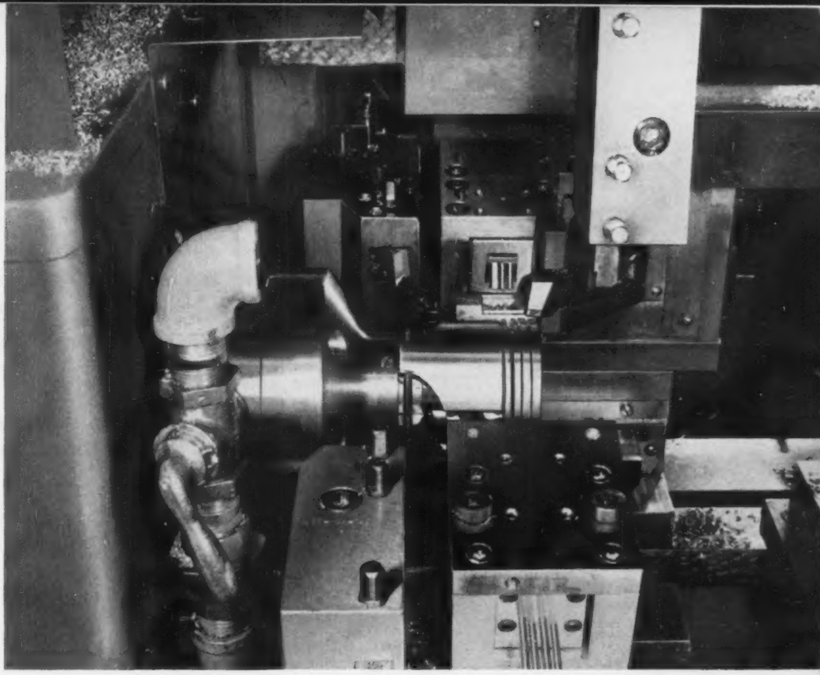


Fig. 11. Close-up view of the tooling on an automatic lathe employed to turn, face, groove, and chamfer cast-aluminum pistons for the V-8 engine.

sides of the ring grooves must be held parallel with the piston head within 0.0002 inch total indicator reading, when the sides are tested radially to depth.

Pistons are weight-balanced on a Morris automatic piston-balancing machine, Fig. 12. In this set-up, the pistons are automatically turned upside down before passing over a scale that weighs the pistons and pre-sets milling cutters for the amount of stock to be removed from the weight bosses. A second scale is used to check the piston weight after milling. Weight-balanced pistons are automatically unloaded onto the belt conveyor seen in the foreground.

When reciprocating parts of the engine have been mounted in the block, assembly is interrupted to permit dynamic balancing, which is performed on special machines developed by General Motors Research Division. After balancing, assembly is completed, and the engines are operated under their own power while inspectors check for oil flow, water leaks, and other factors. The final step is painting, after which the engines are shipped to various assembly plants.

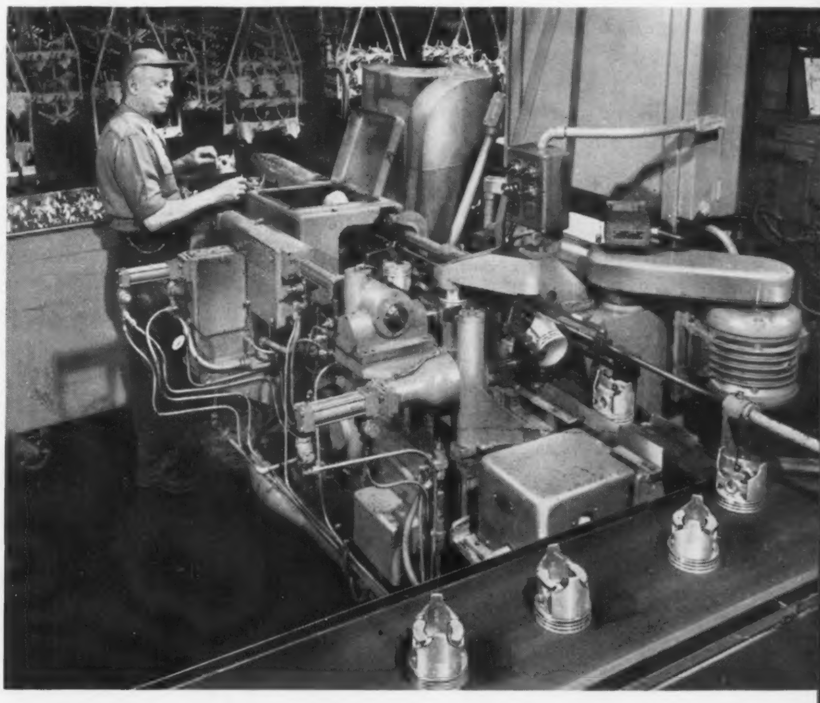


Fig. 12. Automatic piston-balancing machine weighs the parts, removes the required amount of metal by milling, and then reweighs the pistons.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Leaded Steels Can Provide Smooth Machined Surfaces Economically

Lead-treated steels in the J&L 1213 and J&L Type "A" open hearth analyses and also in the J&L 1113 Bessemer analysis were made available by the Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Pa. These steels possess a free-cutting property that facilitates the making of a smooth-finish machined surface.

Advantages claimed for these leaded steels are that the lead acts as a lubricant on the cutting edge of the tool where the chip bears against the tool face. This reduces the generation of heat and minimizes the power needed to cut and deform the chip. Leaded steel will break up into short chips thereby reducing friction and in turn lessening the wear on the cutting tool.

These steels are of particular interest to the screw machine industry in the manufacture of small machine parts which require extensive machining, such as hydraulic fittings and other parts for automobiles, household appliances, textile and business machines, and other equipment.

Chromium-Molybdenum Welding Electrodes Provide High-Strength Joints

Use of "Murex Croloy" welding electrodes in a special system of arc-welding reduces the need for preheating and heat-treatment subsequent to welding, according to the Metal and Thermit Corporation, 100 East 42nd St., New York City. These electrodes and this system of welding is specifically intended for use where chromium-molybdenum steels are welded in the production of equipment for high-temperature and high-pressure service. The weld deposits of these electrodes exhibit good stress-rupture characteristics over a wide range of temperatures.

Designations and weld deposit analyses of the four types of electrodes that are available are: Croloy 1A, chromium 1.00 to 1.25 per cent, molybdenum 0.40 to 0.60 per cent; Croloy 2A, chromium 1.80 to 2.20 per cent, molybdenum 0.40 to 0.60 per cent; Croloy 2 1/4 A, chromium 2.00 to 2.50 per cent, molybdenum 0.90 to 1.10 per cent; and Croloy 5A, chromium 0.40 to 0.60 per cent, molybdenum 0.40 to 0.60 per cent.

Uses to which these electrodes have been put are the fabrication of pipe, high-pressure boilers, and petroleum refinery and chemical-processing plant equipment.

Plastic Tooling Compound for Making Jigs and Fixtures

A viscous, metal-filled plastic material, which can be molded like putty or poured into a form to obtain any desired shape, can now be used to produce jigs, fixtures, plugs, gages, forming dies, holding fixtures, and masking fixtures. "Plastik-Tul," as it is called, can be drilled, tapped, threaded, milled, broached, and sawed with ordinary metal-working tools and equipment. It may also be painted or plated. Cutting oils, solvents, and greases do not affect this material. Two types of this material are available, namely, type 100 which may be applied with a putty knife or spatula to vertical surfaces, and type 200 which is slightly more fluid and may be poured into a form. Both types can be used to make machining fixtures that are to hold and/or position odd- and irregular-shaped work-pieces. Their producer is the Industrial Development and Mfg. Corporation, Needham, Mass.

High-Strength Nickel Alloys for Die-Casting

A series of nickel-aluminum die-casting bronzes, designated by the name "Aur-O-Met," provides strength, corrosion-resistance and ease of machinability according to its producer the Aurora Metal Co., Aurora, Ill.

Two of these alloys are Aur-O-Met 57 and Aur-O-Met 56. The first has an average composition of: aluminum, 12 per cent; iron, 5 per cent; nickel, 7 per cent; and copper, the balance. It has a tensile strength of 120,000 pounds per square inch, a yield strength of 85,000 pounds per square inch, and a hardness of 110 on the Rockwell B scale. The second alloy's composition is: aluminum, 10.50 per cent; iron, 4.25 per cent;

nickel, 4.75 per cent; and copper, the balance. It has a tensile strength of 120,000 pounds per square inch, a yield strength of 60,000 pounds per square inch, and a hardness of 93 on the Rockwell B scale.

Use of these alloys in die-casting has resulted in the discontinuance of the use of steel forgings with bronze overlays and parts machined from solid bronze.

Synthetic Coating Fluids that Burn Cleanly from Metal Parts

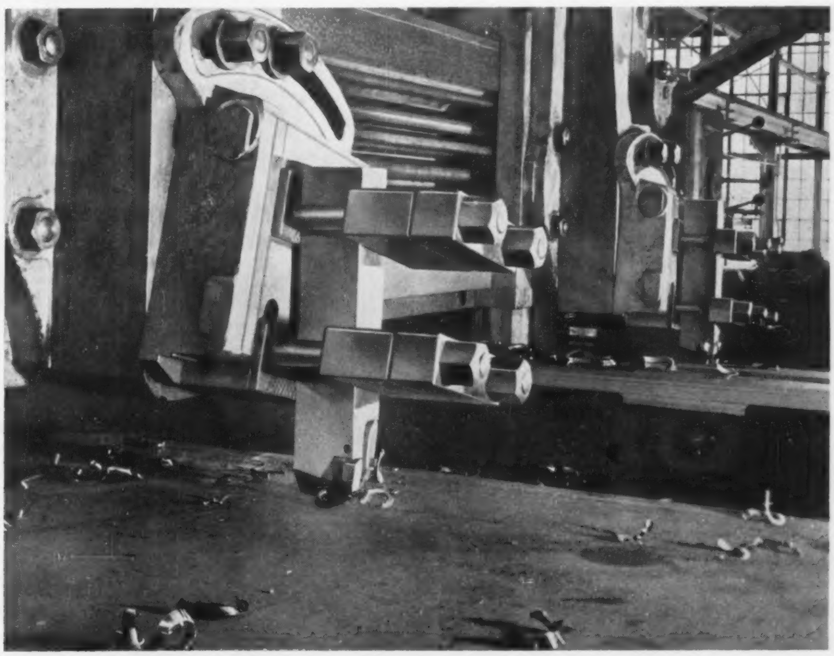
A series of rust-preventive fluids for coating metal parts before storage, that can be burned cleanly from metal surfaces after storage, has been announced by the Union Carbide and Carbon Corporation, 30 East 42nd St., New York City. These coating fluids, marketed under the brand name "Ucon," do not leave residues after burning that interfere with painting, welding, soldering, brazing, or annealing. They can also be removed with solvents or, in some cases, by mild scouring with water. The fluids are available in several viscosity grades and can be used diluted or undiluted. A low viscosity grade of this fluid that keeps drag-out to a minimum can be applied undiluted, or a higher viscosity grade can be diluted with solvents to the proper viscosity. Choice of method depends on the thickness of the residual film necessary to provide complete protection on the particular metal, facilities in the storage area for accommodating solvent vapors, and the economics of using inexpensive solvents as diluents.

Impact- and Cratering-Resistant Cemented Carbides

In order to resist the cratering action of the continuous chip and to provide great impact resistance in cemented carbide tools, the Carmet Division of Allegheny Ludlum Steel Corporation, Pittsburgh 22, Pa. has developed an ingredient, called "Crystalloy," whose use has made possible the production of their recently introduced 600 series of cemented carbides.

Two grades currently available include Grade CA-610 and Grade CA-608; the last two digits indicating the cobalt content which is indicative of the type of service for which the grade can be used. These grades are available in all standard cutting tips and tools, and can be made into special blanks of any shape or size required. Grade CA-610 is designed for use where breakage is the factor limiting tool life such as when cuts are extremely heavy and the surfaces uneven. In these cases the cut may be interrupted, for example, in the turning of a square bar to a round one. This grade has both high hardness and high impact strength.

Grade CA-608 is recommended for light machining and finishing where the conditions limiting tool life are edge wear and cratering. This grade resists abrasion and cratering and maintains an edge strength capable of withstanding the shock loads encountered in finishing cuts on steel where the chip is continuous and where increased speeds and decreased feeds are used. It is most useful when machining steels of high alloy content or other hard materials.



Intermittent cuts were made satisfactorily with this Gray Convertible Openside Planer on a C-1020 steel weldment using two Carmet Grade CA-610 cutting tools. The cutting tools were run at a depth of 1/2 inch with a feed of 0.078 inch at a surface speed of 250 feet per minute.

Aluminum-Pigmented Strippable Coating Protects Metal Surfaces

Production of an aluminum-pigmented strippable coating has been announced by Specialty Coatings, Inc., 1085 Allegheny Ave., Oakmont, Pa. Providing protection for metal surfaces during interim periods, the coating, designated as "PV-845," may be applied by either brush or spray methods. It may be used advantageously on all types of metals during both inside and short-term outside storage; on polished surfaces to prevent marring and scratching; for coating idle tools, dies, etc.; to protect against die marks in stamping operations; as a removable film on inner surfaces of spray booths; and as a web coating to completely enclose bulky objects. It requires no surface preparation and can be stripped easily when desired without leaving a greasy residue. Drying time of the coating depends upon the thickness of the coat. A film 3 mils thick, sufficient to provide adequate strength for stripping, will dry to handle in 5 to 10 minutes.

Rustproof Coating from Handy Push-Button Container

A rustproof coating—containing silicones and polar compounds—specially formulated to prevent rust and corrosion in both outdoor and indoor storage of fine equipment, has been announced by Gard Industries, Inc., 733 Green Bay Road, Wilmette, Ill. This coating, called "Gard Anti-Rust Spray," is packaged as a liquid in a handy push-button container. The film formed is a non-creeping and self-healing film that displaces water and neutralizes fingerprints on gages or tools. It is compatible with all lubricating oils and greases and can be polished, if desired, to form an almost invisible protective film.

Fused-On Silicate Protective Coating for Ferrous Metals

Silicate or glass-like protective coating materials which can be fused to any clean ferrous metal surface at temperatures ranging from 900 to 1200 degrees F. have been made available by Allied Porcenell, Inc., 851 S. Market St., Waukegan, Ill. Identified by the name "Porcenell," they are said to provide inexpensive, permanent protection against rusting and corrosion. The coatings are claimed to be fireproof, scratch resistant, and to have permanence of color.

Applied by spray, brush, or dipping methods, and then fired, these materials are used to coat the surfaces of sheet and plate steel; cast, wrought, and malleable iron; and high-carbon steels. They are obtainable in numerous colors.

Transparent Glazing Material for Safety Applications

A transparent scratch- and abrasion-resistant glazing material highly suitable for a broad range of safety applications has been announced by the Homalite Corporation, 11-13 Brookside Drive, Wilmington, Del. Called "Homalite CR-39," the material is made of thermosetting resins which are immune to chemical action. It is easily machined and virtually unaffected by welding splatter, and should, therefore, find wide application in the metal-working field. The material is lightweight and highly resistant to shatter which makes it useful for such applications as safety goggles and shields, instrument faces, grinding-wheel guards, windows for viewing dangerous processes, cab glazing on power shovels and cranes, and numerous similar uses.

Readily Soluble Compound for Cleaning, Derusting and Descaling

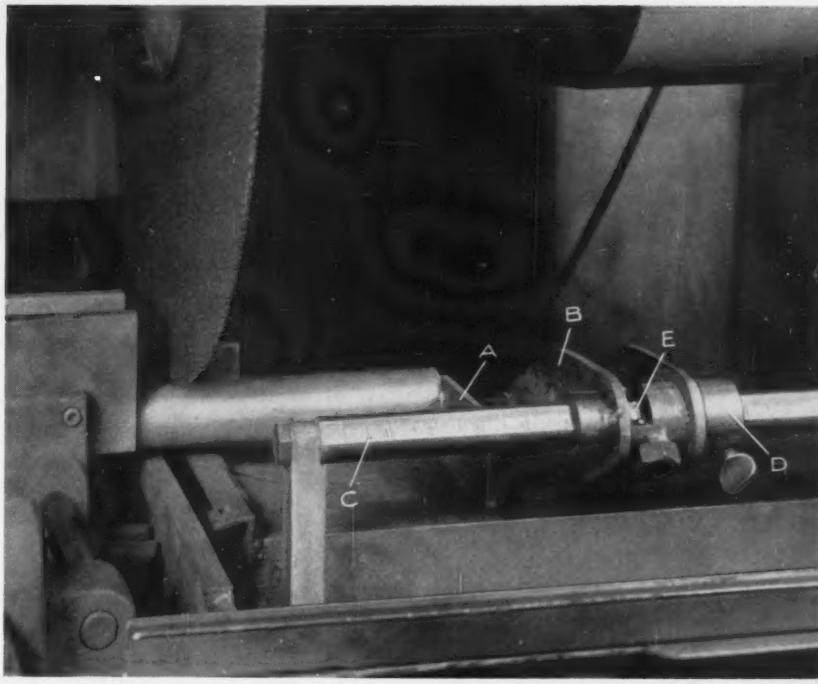
The removal of light to moderate rust, heat-scale, tarnish, and other oxides, as well as normal shop dirt from ferrous metal parts has been facilitated by the use of Oakite Compound No. 131 according to an announcement from Oakite Products, Inc., 126 Rector St., N. Y. 6. N. Y. The compound is a non-viscous, amber-colored liquid having a hydrogen ion concentration (pH) range of from 1.5 to 1.0 at 70 degrees F., and a bulk density of 11.0 pounds per gallon. It is soluble in water or alcohol in all proportions, but is generally used in a concentration range of 5 to 30 per cent by volume. Recommended operating temperatures range from room temperature to 160 degrees F.

Silver Brazing Alloy for 400 Series Stainless Steels

Silver brazing alloy wires of any standard gage, specially developed to overcome crevice corrosion problems in brazing the 400 series straight chromium stainless steels, have been made available by Handy & Harman, 82 Fulton St., New York 38, N. Y. This type of corrosion problem occurs most frequently where the brazed assembly is subjected to water, steam, or humid atmospheres.

Known as RSNI, the alloy contains 63.0 per cent silver, 28.5 per cent copper, 6.0 per cent tin, and 2.5 per cent nickel. It melts at 1325 degrees F. and flows at 1475 degrees F. This alloy does not flatten out at the brazing temperature to form thin fillet edges, a feature which aids in preventing crevice corrosion. However, because of this sluggishness, particular care is required to flow RSNI into the joint.

Stock Stop and Safety Shield for Abrasive Cut-Off Saw



By SIGMUND SMITH, Foreman
Central Shops Department
Argonne National Laboratory
Lemont, Ill.

DEVELOPMENT of an adjustable swinging stop and an enclosure to confine flying sparks during cutting operations on an abrasive cut-off saw was found necessary to reduce wheel breakage and provide safe working conditions at Argonne National Laboratory, Lemont, Ill.

The heat generated in a length of bar stock held against a fixed stop during cutting operations made the bar expand as the wheel passed through. This expansion caused a binding action that resulted in abrasive wheel breakage. The problem was solved by redesigning the standard stop to permit its quick and easy removal before the cutting operation is started.

The stop, shown in Fig. 1, consists of a small plate *A* mounted on a swinging arm *B*. Sliding on a graduated rod *C*, the swinging arm can be locked at the desired distance from the abrasive

Fig. 1. (Above) Swinging stock stop is quickly adjusted for desired cut-off length by aligning wire indicator with appropriate graduation on bar.

Fig. 2. (Right) A transparent plastic shield surrounds abrasive cut-off machine to protect personnel from flying sparks or broken wheel fragments.

wheel by means of a thumb-screw and collar *D*. An indicating wire spans an opening *E* cut in the center collar of the stop-arm. Exact location of the stop can be made by noting the position of the wire on the graduated rod. The stock is fed out until it contacts the stop plate. Vise jaws are tightened on the stock, then the stop is swung clear of the work. In this way the material being cut is free to expand outward instead of being forced back into the abrasive wheel. Upon completion of the cut, the stop can be swung back to its pre-set position.

To protect the machine operator and other personnel from flying sparks, and to eliminate the possible danger from flying particles in case of wheel breakage, it was found necessary to construct a safety hood around the machine, Fig. 2. The enclosure consists of an angle-iron frame having a sheet-metal skin at both ends and on top, and left open at the back and bottom. A transparent plastic panel, which slides vertically to permit quick access to the interior, forms the front surface of the hood.

The operating handle protrudes through a slot in this panel. This slot is so placed that the handle cannot feed the saw into the work until the panel is closed. A smaller plastic panel, having a hole located above center, slips over the operating handle as shown. The purpose of this strip is merely to prevent sparks from passing through the operating slot.

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Telescoping Leg Permits Easy Adjustment of Band-Saw Table

A telescoping leg added to a DoAll band-saw enables cutting angles to be changed precisely and instantly at the Temco Aircraft Corporation, Dallas, Tex. By extending or contracting the leg, cutting angles are changed with the saw in motion—a feature of value when sawing varying contours.

Formerly, the operator had to stop the saw to change the cutting angle. Notches left where the cutting angle was changed then had to be removed with a router. It was possible to cut varying contours, but it was a three-man operation. The operator actuated the saw blade and guided the material. One assistant called out degree changes, using a level and protractor, and another supported and moved the table.

The leg consists of a length of threaded rod which fits inside a sleeve made of tubing. The upper end of the rod is pinned to the bottom of the table, and the lower end of the tubing is pinned to the machine base. Engaged to the rod is a large handwheel having a threaded bore. Weight of the table is borne by the thrust of the wheel against a shoulder on the upper end of the tubing. Rotating the wheel shortens or lengthens the exposed portion of the rod, thus affecting the angular disposition of the table.

• • •

Three-Dimensional Planning Workshop

Three-dimensional planning for plant lay-out will be the subject of a Forum and Workshop to be held in Pittsburgh, Pa., June 13 to 17. Designed to acquaint lay-out engineers with the latest techniques in plant planning, the workshop is being conducted by a college-industry group.

Each of the five sessions will be divided into a morning lecture and discussion period, and an afternoon workshop period where course participants will actually apply these new techniques. A completely equipped lay-out laboratory will be provided, both for three-dimensional and two-dimensional studies. For information on enrollment, write Plant Layout Technical Workshop, P.O. Box 225, Oakmont, Pa.

Telescoping leg attached to under side of table permits the cutting angle to be changed while band saw is in operation.

Transfer Machining of Water-Pump Housings

CAST-IRON housings for automotive water pumps used on Chrysler automobiles are machined at the rate of 103 per hour (at 100 per cent efficiency) on the special transfer machine seen in Fig. 1. This machine, made by Snyder Tool & Engineering Co., and installed at the Chrysler-Jefferson plant in Detroit, Mich., contains twenty-four stations for drilling, reaming, tapping, milling, boring, facing, countersinking, recessing, and slitting the housings. Also included are automation devices for repositioning the castings by rotating and turning them over, and inspecting drilled holes prior to tapping.

The water-pump housings, such as the one shown at the left in Fig. 2, are received at the transfer machine with the bottom surface and two bosses on each casting machined. Also, two locating holes and six other mounting holes in each part have been machined previously. The housing seen at the right gives some idea of the numerous holes and surfaces that are cut on the transfer machine.

Castings are manually loaded into the transfer machine on their sides, and are automatically clamped at each of the stations by hydraulically actuated, cam- and wedge-operated clamps, Transfer of the housings from station to station, up to Station 17, is accomplished by sliding the castings along rails by means of a hydraulic transfer bar having counterweighted pushing fingers. For advancing the work-pieces, the fingers are raised by means of the counterweights, and on the return stroke of the transfer bar, the fingers are lowered by contact with the water-pump housings.

From Stations 17 to 24—after the parts have been rotated 90 degrees and turned over 180 degrees—the housings are transferred by a walking beam unit. With this set-up, each casting is lifted, advanced one station, and lowered into the next station. Hydraulically operated locating pins enter the previously machined holes in the castings at each station.

After being loaded at the first station and automatically transferred to the second station, the water-pump housings are bored to a diameter of 4.406 inches and plunge-faced. Both operations are performed with a single combination milling cutter (having eight carbide-tipped blades) which is mounted on the spindle of a right-hand

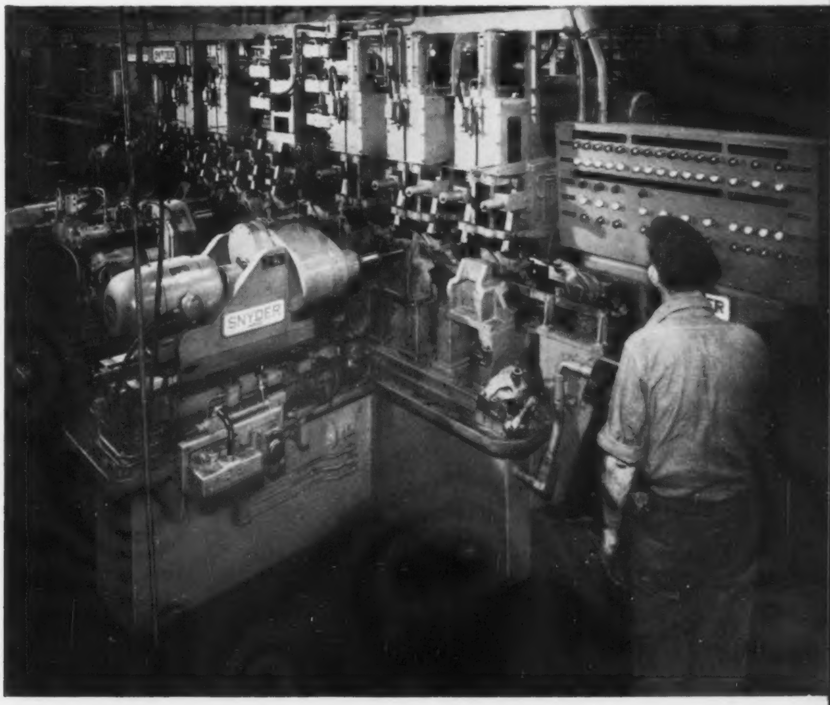


Fig. 1. Loading end of a twenty-four-station transfer machine which performs a variety of operations on 103 automotive water-pump housings per hour

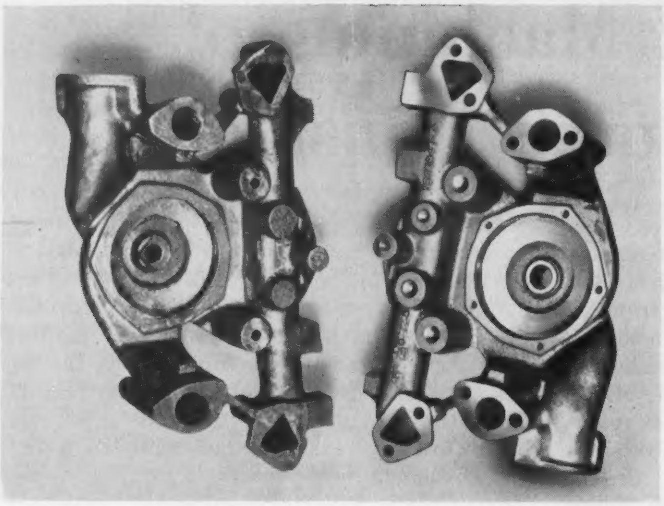


Fig. 2. Cast-iron water-pump housings as they appear prior to (left) and after (right) passing through transfer machine seen in Fig. 1

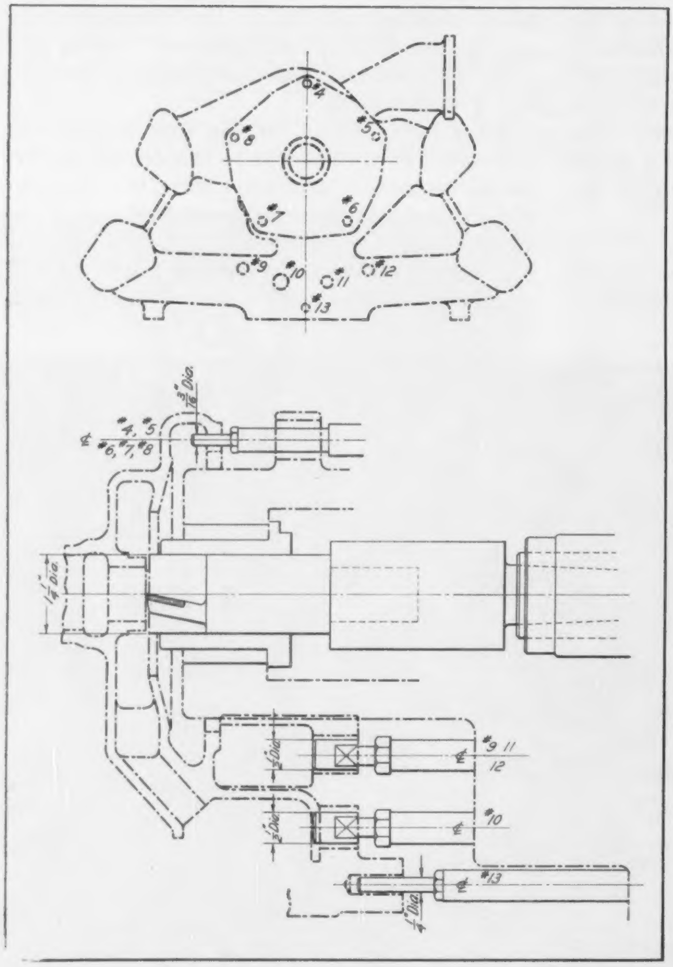


Fig. 3. At the eleventh station of the transfer machine, hydraulically operated probing pins check ten previously drilled holes in preparation for subsequent tapping.

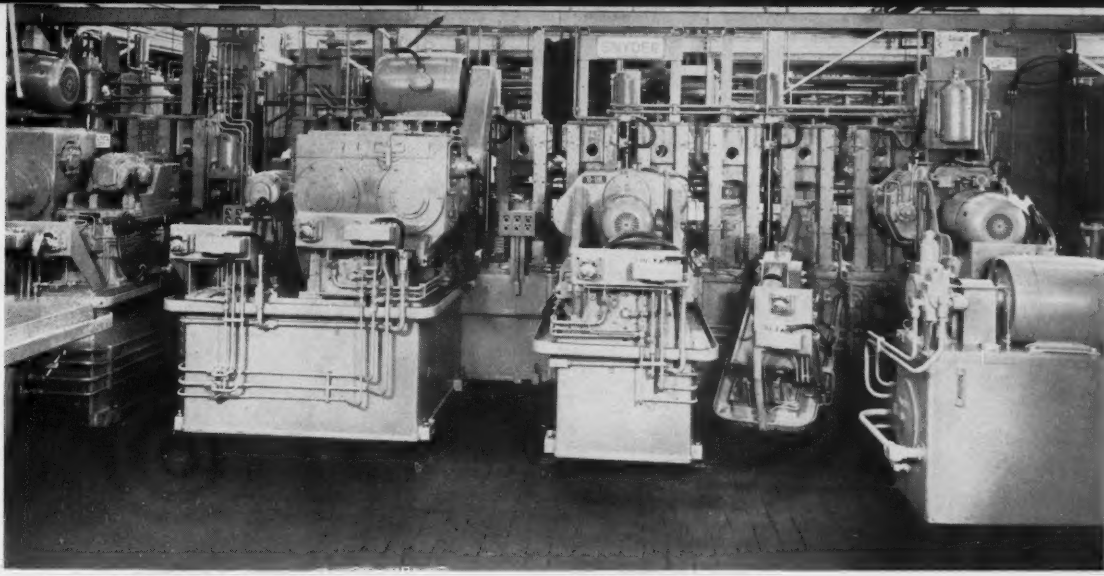
head. The cutter is rotated at 101 R.P.M., providing a cutting speed of 150 feet per minute, and fed 0.032 inch per revolution. A tapered impeller seat in the housing is rough-faced at the third station by plunge cutting with a milling cutter having four carbide-tipped blades.

Four holes, varying from 27/32 to 1 5/32 inches in diameter, are drilled in each cast-iron housing at Stations 3 and 4 by using four-flute carbide-tipped, combination core-drills. These tools, mounted on the spindles of left-hand heads, are rotated at a cutting speed of 150 feet per minute and fed 0.020 inch per revolution. Two other holes are spot-faced, and five more holes are drilled and countersunk at Station 4.

Station 5 is idle, and at the sixth station, the housings are plunge-faced and internally grooved. A solid carbide blade is used to cut the groove, which is 0.075 inch wide and 0.061 inch deep. Left- and right-hand heads at the seventh station are tooled to plunge-face, chamfer, and bore the castings, spot-face five holes, and countersink one. The tapered impeller seat is finish-faced at Station 8 by plunge cutting with a milling cutter having four carbide-tipped blades.

The hub of the water-pump housing is gashed by means of a slitting saw 1/8 inch wide by 2 inches in diameter mounted on the spindle of a left-hand head at the ninth station. A right-hand head at Station 10 is employed to drill four holes and spot-face one hole.

Holes that have been drilled at previous stations and that are to be tapped at subsequent stations, are inspected at Station 11. Here, as shown diagrammatically in Fig. 3, hydraulically operated probing pins are provided on a right-hand head to check ten drilled holes. If the probing pins contact the casting (where holes should have been drilled) or broken twist drills, the pins back up and contact limit switches which automatically stop the machine. In



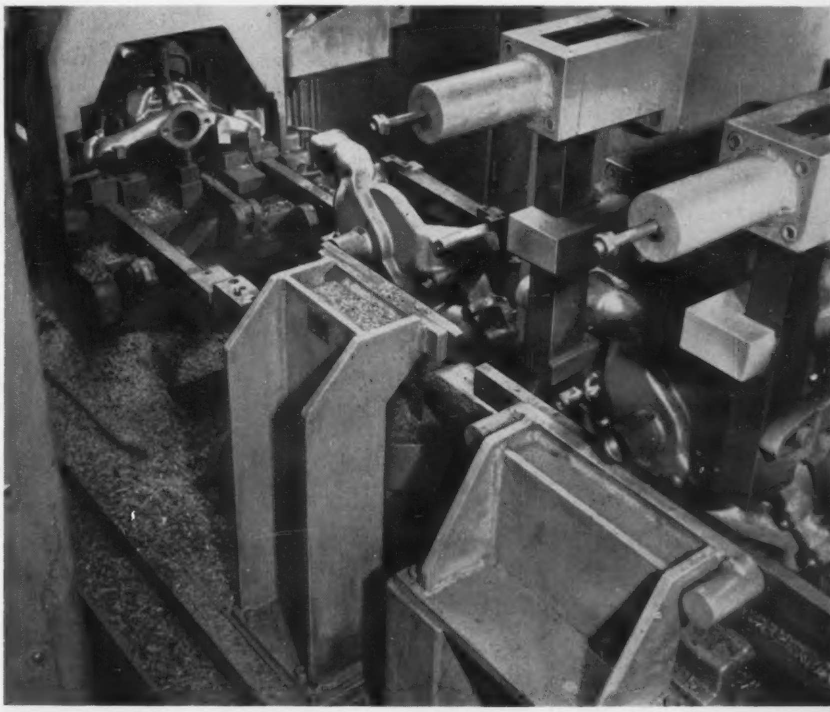
this way, tool breakage in subsequent tapping operations is minimized and castings which do not have the operation completed are stopped immediately.

The same right-hand head at the eleventh station is also equipped with a spot-facing tool having four carbide-tipped blades for facing a hub in each casting. This tool is rotated at 487 R.P.M. to provide a cutting speed of 150 feet per minute, and fed at the rate of 0.0116 inch per revolution. A hole is reamed to a diameter between 1.1785 and 1.1890 inches at Station 12 (using an eight-flute carbide-tipped reamer), and a 3/16-inch diameter hole is drilled into the housings at an angle of 57 degrees at Station 13. The ten holes that have been previously drilled and checked are tapped at the fourteenth and fifteenth stations. In Fig. 4, a side view of the transfer machine shows the right-hand heads employed from the fourth station (seen at the left) to the fifteenth station (right).

As can be seen in Fig. 5, the water-pump housings reach Station 16 resting on their sides. Here, each housing is rotated through an angle of 90 degrees in a horizontal plane. Then, between Stations 16 and 17—a distance of 11 inches—the casting is turned over 180 degrees in a vertical plane, as shown in Fig. 6. Both the rotating table and hinged fixture are actuated by hydraulic motors and controlled by limit switches.

Fig. 4. (Above) Side view of transfer machine showing right-hand heads employed from the fourth station to the fifteenth station

Fig. 5. (Right) At Station 16, the cast-iron water-pump housing, resting on its side, is rotated 90 degrees in a horizontal plane.



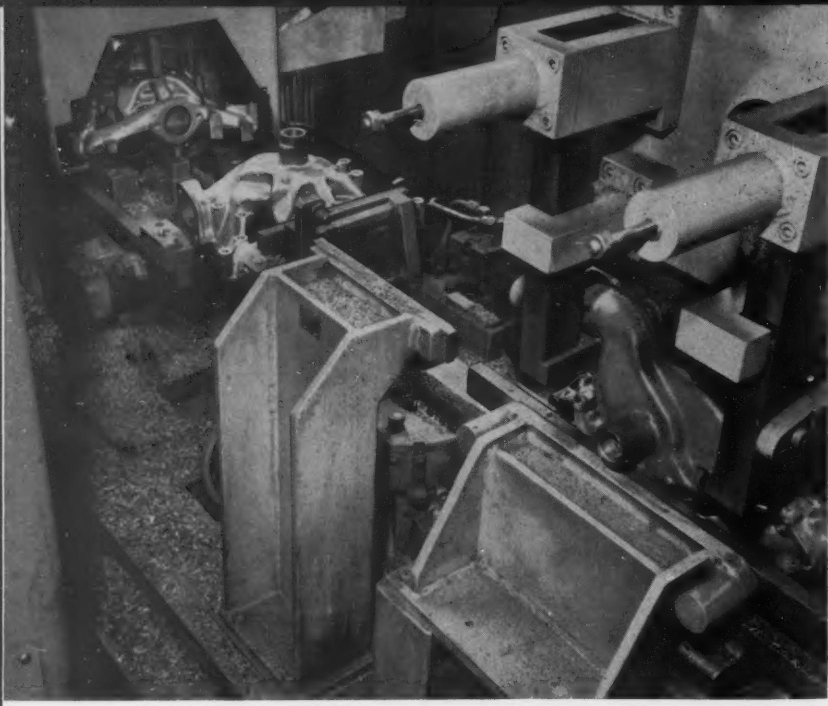


Fig. 6. In being transferred from the sixteenth to seventeenth station, the housing is turned over 180 degrees in a vertical plane.

As previously mentioned, from Station 17 to the end of the machine, the work-pieces are transferred by a walking beam. Clamping is accomplished at each of these stations from overhead by hydraulically operated pins. A cutter 4 inches in diameter and carrying eighteen solid carbide blades is used at the eighteenth station for facing the housings.

Station 19 is idle, and two holes are drilled and countersunk at the twentieth and twenty-first stations. Station 22 is also idle; two holes are tapped at Station 23; and the water-pump housings are unloaded at the twenty-fourth and final station of the transfer machine. An illustration of the machine, viewed from the unloading end, is shown in Fig. 7.

Production on this transfer machine is controlled by the following cycle times:

	Seconds
Load and clamp	3
Rapid approach	2
Feed	19
Rapid return	3
Unclamp and unload	3
Index	5
Total cycle time	35

Feeding time is controlled by the reaming operation performed at the twelfth station. This reamer, which is 1.1785 inches in diameter, is rotated at 243 R.P.M. to obtain a cutting speed of 75 feet per minute, and fed at the rate of 0.022 inch per revolution.

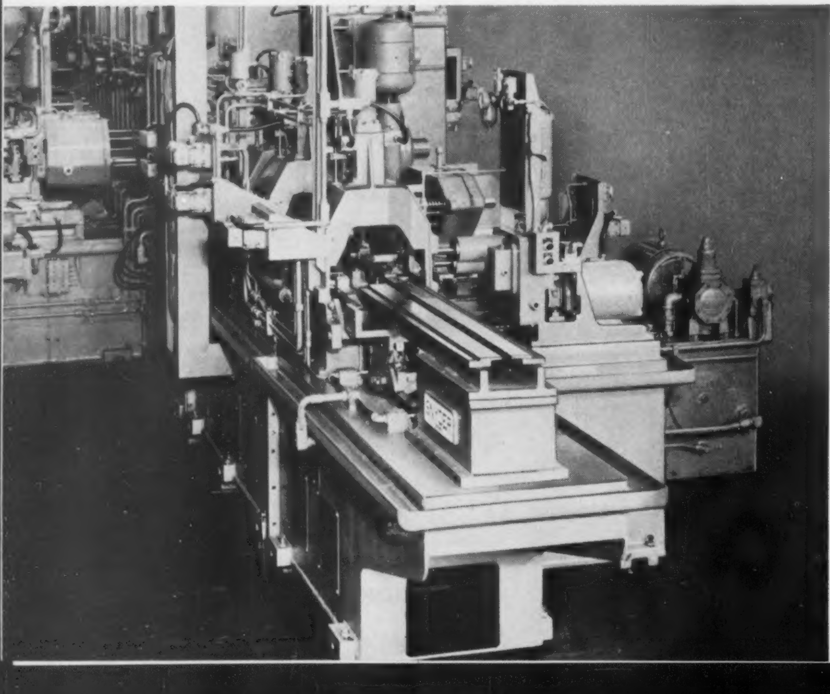


Fig. 7. Unloading end of twenty-four-station transfer machine. At the last four stations, castings are clamped from above by means of hydraulically operated pins.

Press Operations on a Vacuum Cleaner Part

MANUFACTURE of the distinctive "Universal Jet 99" vacuum cleaner is well integrated at Landers, Frary & Clark, New Britain, Conn. Among the various press operations of interest are those concerned with forming the outer case of the cleaner.

The initial deep draw of the part, a 50 per cent reduction, is shown in progress on an H-P-M 200-ton press in Fig. 1. As a preparatory step, 0.030-inch thick aluminum-killed sheet steel blanks, seen at the left in the illustration, are roll-coated with drawing compound. The main slide, the blank-holder slide, and the die-cushion platen inside the bed of the press all operate during the press cycle.

After a coated blank is positioned over a die ring which surrounds the die, the main slide and the blank-holder slide descend as a unit. When the blank-holder slide reaches the blank, its movement is arrested and pressure is applied on the blank over the die ring. The main slide, carrying the punch, continues to descend independently, drawing the blank into the die cavity.

Fig. 1. (Above) The main slide, blank-holder slide, and die-cushion platen of this 200-ton press are operated in the first draw.

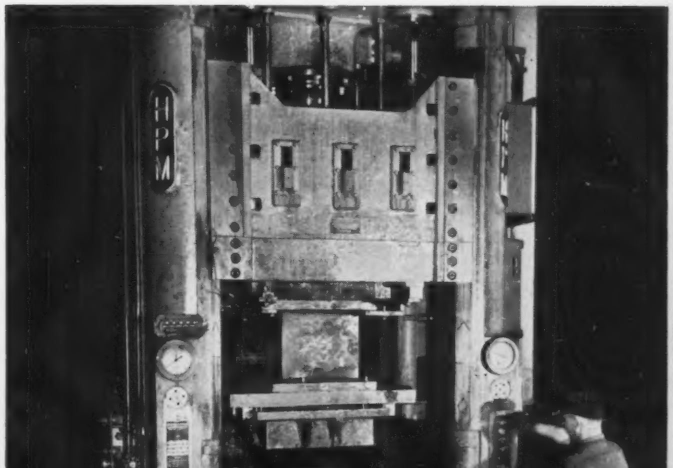


Fig. 2. (Right) The outer case of the cleaner is restruck in an inverted position.

Fig. 3. Embossing the long sides of two cases simultaneously. This step adds strength to the cases.

Normally, the top of the die is held flush with the die ring by upward hydraulic pressure. The die cushion platen exerts this pressure against the bottom of the die by means of pins that extend through the bolster plate. As the punch descends, the die is forced down to the bolster plate against this pressure. Then, on the up stroke of the cycle, the pressure against the bottom of the die is momentarily delayed while the punch and blank-holder are elevated. The platen thus is utilized as a kick-out for the drawn part. Production averages eighty-six parts per hour.

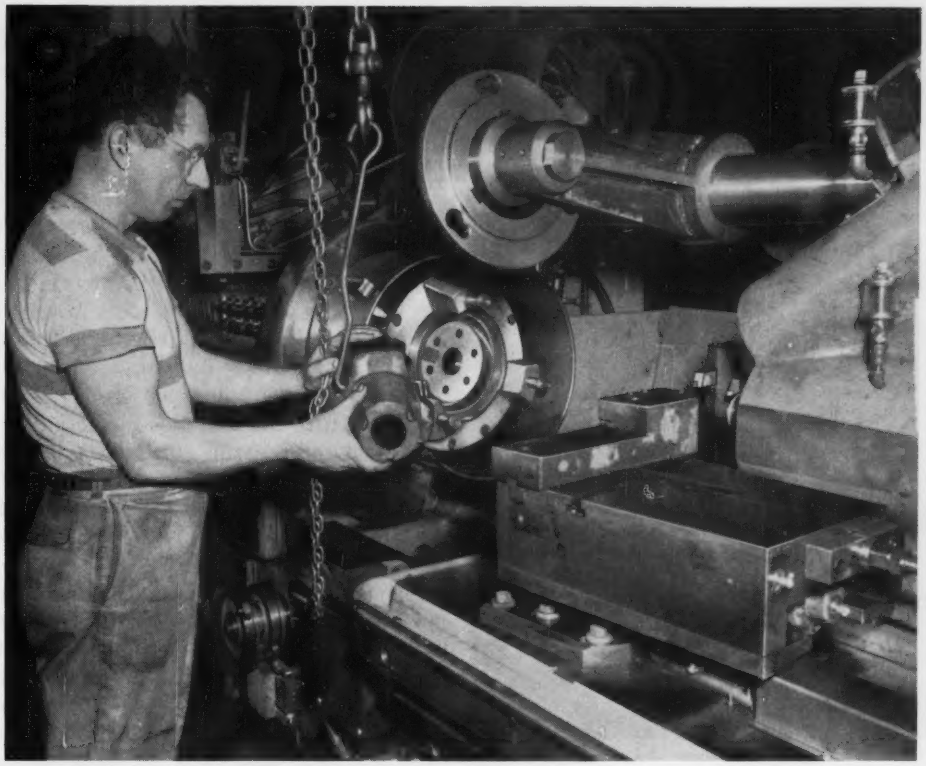
The second operation, called a restrike, consists of drawing the case deeper and forming a reinforcing ridge around the bottom. Restriking is done immediately after the initial draw, to avoid any age-hardening of the metal. It is performed on an adjacent companion H-P-M 200-ton press.

Here, the case is handled in an inverted position with the punch fastened to the bolster plate and the die cavity fastened to the main slide, as seen in Fig. 2. The blank-holder slide is inoperative, and is bolted to the bottom of the main slide. Here, production is at the rate of 140 parts per hour.

To strengthen the long sides of the case they are then embossed on the Bliss straight-side press illustrated in Fig. 3. Two parts are handled together, one side of each being embossed simultaneously in each cycle of the press. Subsequently, the parts are swung around 180 degrees and interchanged on the dies, and the second side of each is embossed.

In the following press step, a 6-inch opening is pierced in the top of the case to receive the vacuum cleaner bag. Another Bliss straight-side press, Fig. 4, performs the operation. At the same time, a step and wall are formed around the opening. With the press operations completed, the cases are conveyed to a Metalwash degreasing unit, where the drawing compound is removed and the work cleaned and dried in a three-minute cycle.

Fig. 4. The final press operation consists of piercing a hole into which the bag is fitted.



Automatic Lathe Features Special Loading Attachment and Tailstock

THE combination of a special pneumatic swinging loading attachment and a special tailstock on a modern, single-spindle automatic lathe now simplifies work handling and speeds machining of bulky oil-well rock-bit assemblies.

The lathe, a Gisholt No. 3D Simplimatic, produces at a rate equal to three manually-operated turret lathes, and can accommodate several different sizes of rock bits. Each work-piece is a complete bit assembly, consisting of three sprocket-like cutters housed in a three-section forged and welded steel spider. Required machining consists of finishing the shank end of the spider—chamfering the inside diameter, facing, and taper-turning the outside diameter. The two assemblies in Fig. 1 show the "before and after" appearance of the shank.

Loading and aligning the heavy, unwieldy

Fig. 1. Machining operations performed on oil-well rock-bit assemblies consist of chamfering, taper-turning, and facing the shank.

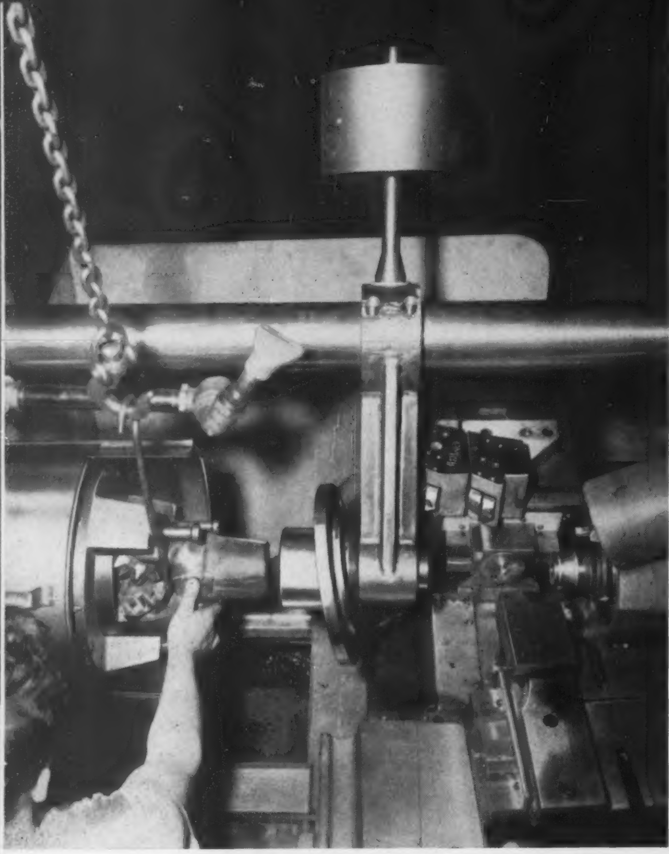


Fig. 2. With the work nested in the fixture, the arm is lowered to the spindle center line, a clamp ring is slipped over the arm, and the attachment bar is thrust toward the headstock.

work-pieces in the fixture have been facilitated by the attachment installed on the machine, seen in the heading illustration. The operator first employs a cable hoist to lift the work over the bed of the lathe and place it in the fixture. The swinging loading attachment is then brought into use.

This device consists of a heavy bar positioned horizontally above the lathe and connected at its headstock end to a piston operating in a pneumatic cylinder. The bar has a lateral movement of several inches, and is also free to rotate, so that a counterbalanced arm fixed on the bar can be swung down to the spindle center line. This position of the arm is illustrated in Fig. 2.

With the assembly loosely nested in the fixture, a clamp ring is slipped over the end of the arm. The bar is then moved to the left, thrusting the work firmly into the fixture. While the arm is in this position, the operator brings the clamp ring up to the fixture. Locking slots in the ring (visible in the heading illustration) engage studs projecting from the fixture. A slight rotation of the ring secures it in position.

The fixture itself is also air-actuated, a drawbar next pulling the studs in and causing the ring to exert a heavy end-pressure against the work. With the attachment bar then retracted and the arm swung upward, the work is ready for machining.

Taper-turning the outside of the shank is performed from the front tool-slide. This unit is mounted on the table to cut the required degree of taper. During the operation, the end of the shank is supported by a revolving center held in a hydraulic tailstock. As can be seen in Fig. 3, the tailstock has dual spindles—a horizontal spindle holds the revolving center, and an angular spindle holds a chamfering tool. The illustration shows the chamfering tool as it is about to cut a conical seat in the shank end. Subsequently, the angular spindle is retracted, and the horizontal spindle advanced until the revolving center bears against the seat. The work is then ready to be taper-turned.

Spindle speed for the turning operation is 300 R.P.M., with the front slide feeding at 0.030 inch per revolution. Also, cutters on the rear tool-slide feed in at 0.010 inch per revolution to face the shoulder and the end of the shank. Floor-to-floor time for machining the assemblies is only two minutes and fifteen seconds.

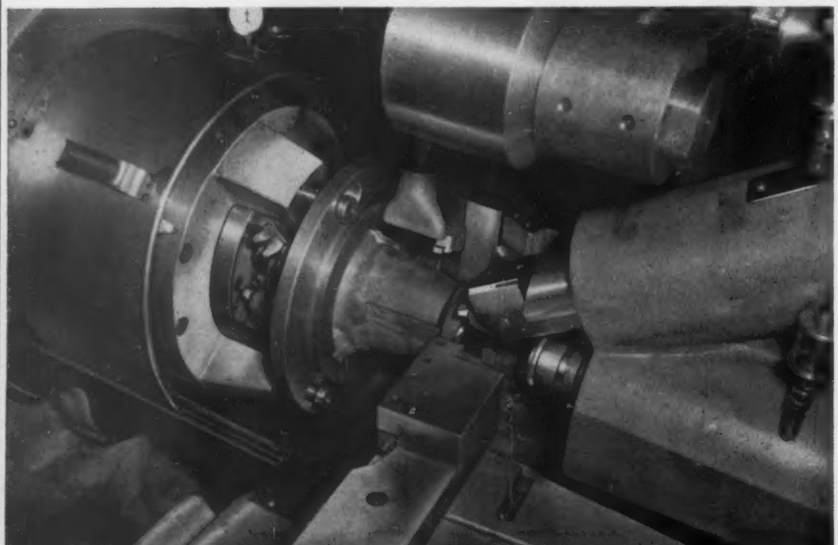


Fig. 3. The dual-spindle design of the tailstock holds both the chamfering tool and the revolving center.

INGENIOUS *Mechanisms*

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Excessive-Torque Reversing Mechanism

By H. B. SCHELL, Brooklyn, N. Y.

A rotating drum type hopper, used to feed small molded parts into a chute, was subject to occasional jamming. The simplest way to free the jam was to reverse the direction of hopper rotation. To do this automatically, the illustrated mechanism was designed.

Two bevel gears *A* and *B* are free to turn on drive shaft *C*. Smaller bevel gear *D*, which is keyed to the hopper shaft, is in constant mesh with the two larger bevel gears. Keyed to the drive shaft is a central driving member *E*. Two stepped hubs *F* and *G*, each free to turn on the drive shaft, carry pins *H* and *J*.

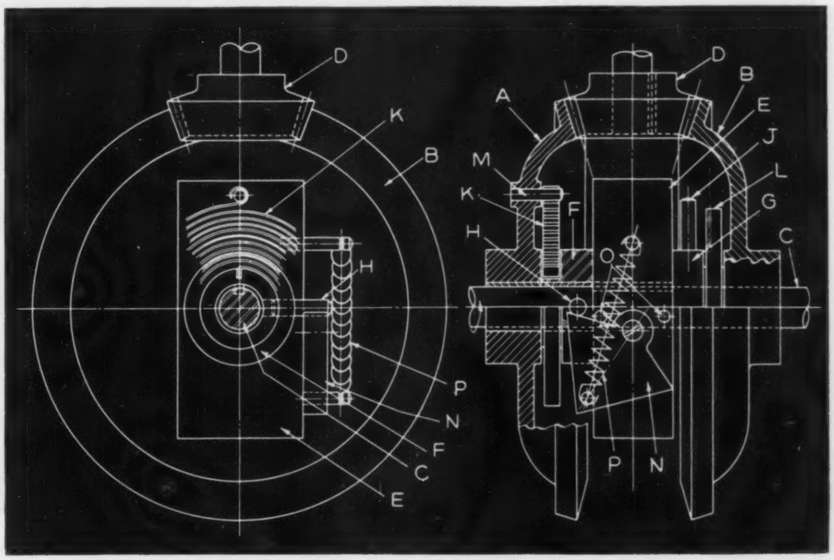
Spiral springs *K* and *L* connect the two hubs to their respective bevel gears by means of pin *M* in the case of spring *K*, and a similar pin, not shown, in the case of spring *L*. The primary function of the spiral springs is to absorb any shock load that might occur in the event of hopper jamming. Driving dog *N* is secured to member *E* by means of a shoulder screw on which it is free to pivot. The dog is held against one of the two stop-pins *O*, by toggle spring *P*.

During operation, drive shaft *C* rotates in the direction of the arrow. With driving dog *N* in its left-hand position as shown, motion is transmitted from member *E* to stepped hub *F*, and from there, through spiral spring *K* to pin *M*. This causes bevel gear *A* to become the driving gear with respect to driven bevel gear *D* on the hopper shaft. Under these conditions, bevel gear *B* merely idles.

Any jamming that occurs during operation of the unit causes an increase in the torque necessary to drive the hopper. As a result, spiral spring *K* is placed under load. When sufficient pressure is built up between pin *H* and driving dog *N* to overcome the initial tension in toggle spring *P*, the dog will pivot about its mounting screw and come to rest against the right-hand stop pin *O*. This releases the driving load from the components on the left.

Continued rotation of drive shaft *C* in its normal direction causes the right-hand side of the driving dog to engage pin *J* in stepped hub *G*. Through spiral spring *L*, and a pin similar to *M*, the driving force is now transmitted to bevel gear *B*. This, of course, forces the hopper to rotate in the opposite direction.

Direction of hopper rotation, driven by gear (D), is reversed by the pivoting action of a driving dog (N) whenever excessive torque is built up.



Common Drive for Two Slides with Partially Synchronized Travel

By W. M. HALLIDAY, Southport, England

A lever drive mechanism installed in a wire-bending machine now produces a high degree of versatility in the equipment. The mechanism has permitted two existing tool-slides to operate with partially synchronized travel, so that different sizes and forms of wire can be handled, and a greater variety of bent shapes can be produced.

Both tool-slides reciprocate in the same horizontal plane, but are a considerable distance apart in the machine. The mechanism transmits the drive from a common shaft, centrally located, which oscillates through an arc of 40 degrees. The first tool-slide has a short, fixed travel; the other, a considerably longer and adjustable travel. Although both tool-slides start and stop together, the second moves in unison with the first only during the initial portion of the forward travel and the final portion of the return travel. In the interim the second tool-slide increases in speed so as to compensate for its greater length of travel.

A full-scale diagram of the mechanism appears in Fig. 1. The oscillating drive-shaft *A* is carried in the bearing bracket *B*. Keyed to the drive-shaft and oscillating with it is a lever *C*. Through a slot in the top of the lever is cross-pinned a connecting link *D*. The opposite (left-hand) end of this link, not shown, is joined to the first tool-slide, which has the short, fixed travel.

A bellcrank *E* fulcrums on a stud *F* extending from one side of the lever. The second tool-slide with the long, adjustable travel, is joined to another connecting link *G* cross-pinned in a slot in the upper arm of the bellcrank.

The lower arm of the bellcrank extends laterally, being supported by a roller assembly *H* mounted on the top of the bracket. The height of the assembly is calculated so that the arm has a light contact with the roller when the mechanism is in its starting position, illustrated in Fig. 1. Also, the vertical center line of the roller is about 1/8 inch to the right of the vertical center line *X-X* of the drive-shaft.

The ratio of the radii of the arms of the bellcrank determines the stroke-length range of the second tool-slide. In this particular instance, the radius of the lower arm is approximately two-thirds that of the upper arm.

At its extremity, the lower arm of the bellcrank contains a short dowel pin *J* which is a sliding fit in the slot *K* of a link *L*. This link pivots in a channel in the bearing bracket, and is at a slight working clearance behind the lower arm of the bellcrank. A stroke adjusting screw *M* is located in an integral rib in one side of the bearing bracket, to the right of the bellcrank. As will be explained, this screw controls the extent that the second tool-slide travels in unison with the first tool-slide.

To the left side of lever *C* is doweled and screwed a short rectangular plate *N*. This plate extends across the adjacent side of the bell-

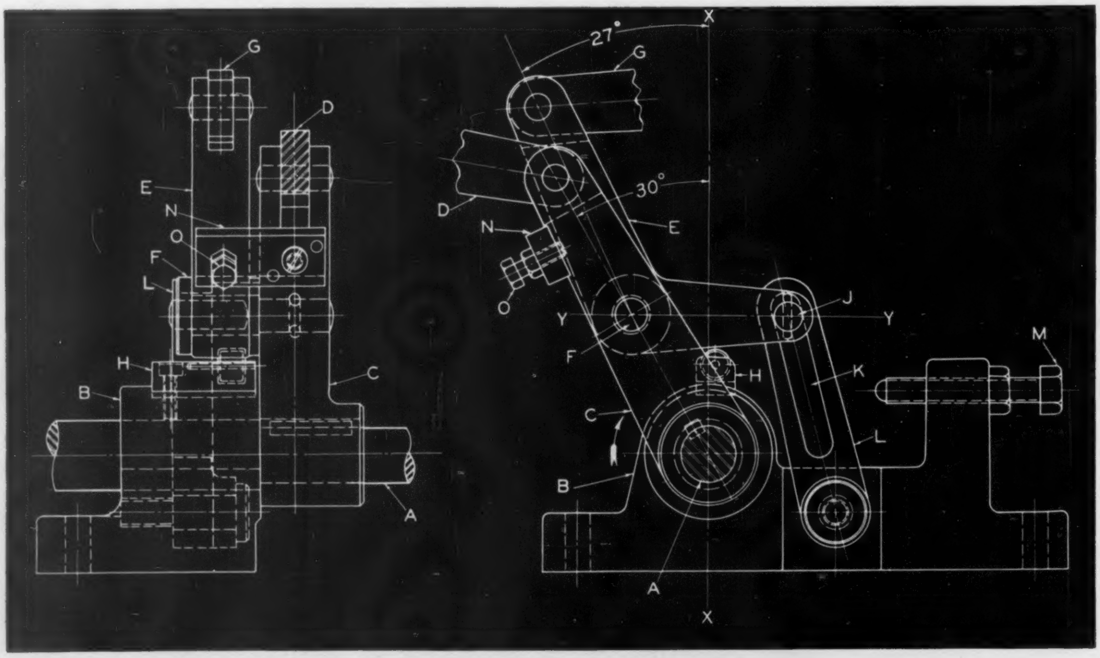


Fig. 1. At the start of the forward stroke, the bellcrank (E) moves in unison with lever (C).

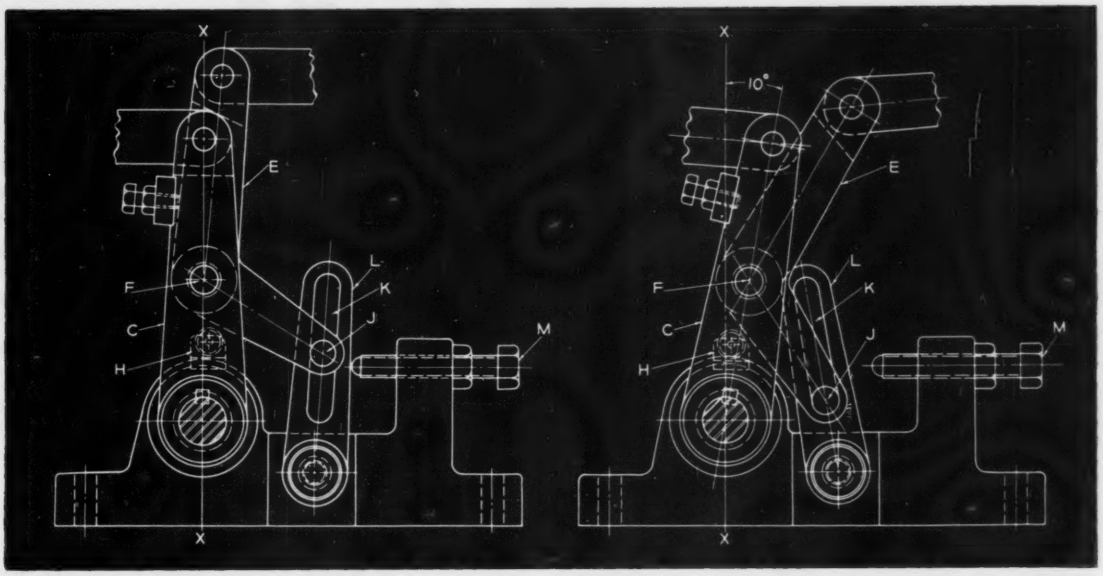


Fig. 2. (Left) When link (L) abuts screw (M) the bellcrank (E) starts to fulcrum on stud (F).
Fig. 3. (Right) At the end of the forward stroke, pin (J) has descended to the bottom of slot (K).

crank, and serves to transmit the forward motion of the lever to the bellcrank. Because of the slightly different angularity of the bellcrank, its side is somewhat clear of the plate. So that both tool-slides can start in unison, a set-screw *O* in the plate is adjusted to bear on the bellcrank.

When the drive-shaft starts its forward, or clockwise, oscillation—indicated by the arrow—lever *C* lies at an angle of 30 degrees to the left of the drive-shaft center line *X-X*, and the upper arm of the bellcrank lies at an angle of 27 degrees; and pin *J* is on the horizontal center line *Y-Y* of stud *F*. Movements of the lever and bellcrank continue in unison until the lever is vertical, as in Fig. 2. At this point, link *L* has also pivoted clockwise into contact with screw *M*, and pin *J* has descended part way down slot *K*.

Since no further pivoting of the link is possible, continued movement of the lever is not transmitted uniformly to the bellcrank. Instead, the bellcrank fulcrums on stud *F* for the final 10 degrees of forward oscillation, Fig. 3; pin *J* descends to the bottom of the slot, and the link pivots to the left. Thus, the upper arm of the bellcrank, with its combined movements, travels in a considerably longer arc than the lever, causing the second tool-slide to travel a correspondingly greater distance and at a greater speed than the first tool-slide.

As counter-clockwise rotation begins, the lower arm of the bellcrank rides over the roller assembly *H*, forcing pin *J* to rise in the slot. At the same time, the link pivots to the right into contact with screw *M*. Then, the bellcrank and lever move in unison for the balance of the return stroke. Thus, during the return stroke, the second tool-slide starts rapidly, then slows down to the speed of the first tool-slide—the reverse of the action during the forward stroke.

* * *

"Wear Theory" Will Be Topic of Two-Week Summer Program

"Wear Theory in Metal Cutting and Bearing Design" will be the subject of a two-week summer program to be offered by the Metals Processing Division of the Mechanical Engineering Dept. at the Massachusetts Institute of Technology, Cambridge, Mass., June 27 through July 8.

The types of wear that normally contribute to the gradual deterioration of surfaces will be considered, and new developments in the theories that have been devised to explain this wear will be discussed. Lecture topics will include the structure and properties of solids and lubricants, techniques for use in wear studies, wear studies involving radioactive tracer methods, temperature and wear characteristics of cutting tools and grinding wheels, and machinability and machining economics. Small groups will be formed to work on special laboratory problems of both fundamental and applied types.

Dormitory rooms can be reserved. Full details and application blanks for this special program may be obtained from the Summer Session Office, Room 7-103, Massachusetts Institute of Technology, Cambridge 39, Mass.

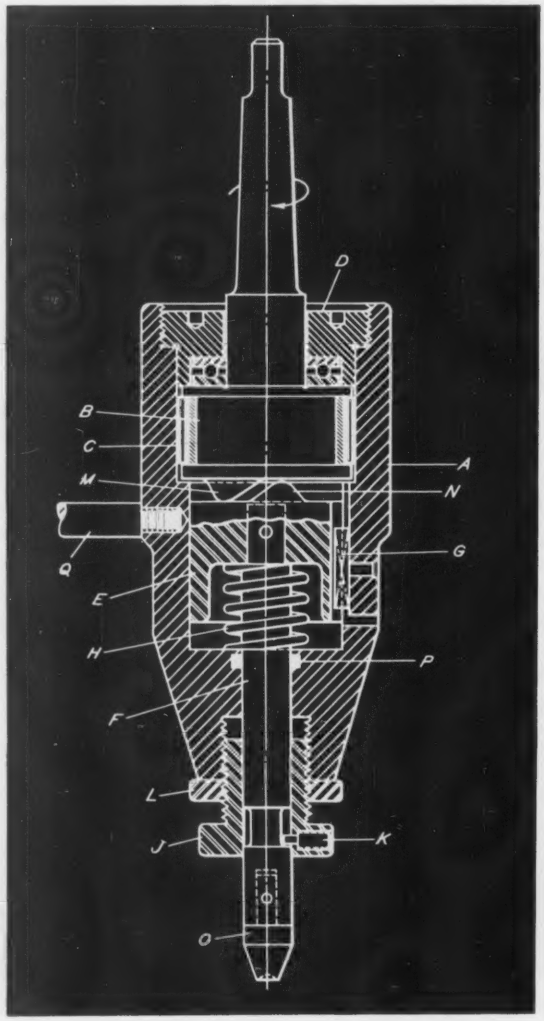
TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

High-Speed Riveting Attachment for Drill Press

By William H. Morson, Birkdale, England

A high-speed riveting device has been designed for use with a conventional drill press. The drive shank of the unit is tapered to fit the drill press spindle from which it derives its power. Changes in the rotational speed of the spindle will proportionally affect the rapidity with which the peening strokes occur.



Riveting attachment for drill press provides one blow for each revolution of the spindle.

The components of the tool, shown in the accompanying illustration, fit within a tubular steel body *A* that is bored out to five different diameters. Located within one of the step bores is a grooved spindle B. The largest portion of the spindle is 1/16 inch smaller in diameter than its corresponding body bore. A needle bearing *C* maintains concentricity.

The upper end of the body bore is threaded to receive cap *D* which is screwed snugly against the bore shoulder. A hole is bored through the cap enabling it to slip over the spindle shank. For tightening purposes, a series of blind holes to accommodate a spanner wrench is also provided. A ball-thrust bearing is housed within a counterbore in the lower face of the cap.

Situated immediately beneath the spindle is sleeve *E*, cross-pinned to the small end of rod *F*. Rotation of these two members within the body is prevented by key *G* which restricts movement to a reciprocating motion. Approximately 3/8 inch is the limit of the sliding movement in this case. Coil spring *H* maintains the two members in their normal raised position as shown.

An adjusting-screw *J*, a close sliding fit over the lower end of rod *F*, is threaded into a recess in the conical end of the body. A dog point set-screw *K* passes through the adjusting-screw flange radially and extends into an annular groove cut around the circumference of the rod. The width of the groove is equal to the sum of the set-screw dog diameter and the maximum amount of sliding movement possessed by the sleeve and rod. Circular lock-nut *L* is threaded on the shank of the adjusting-screw to provide a means of securing it to any desired setting. The peripheries of both the screw and nut are knurled to facilitate gripping. By means of this set-up, the length of riveting stroke imparted to rod *F* may be altered as needed to suit various requirements.

Formed integrally on the lower end of spindle *B* is node *M*, 3/8 inch high and 1/2 inch thick. The leading side of the node (left-hand side) is inclined steeply, while the trailing side is in-

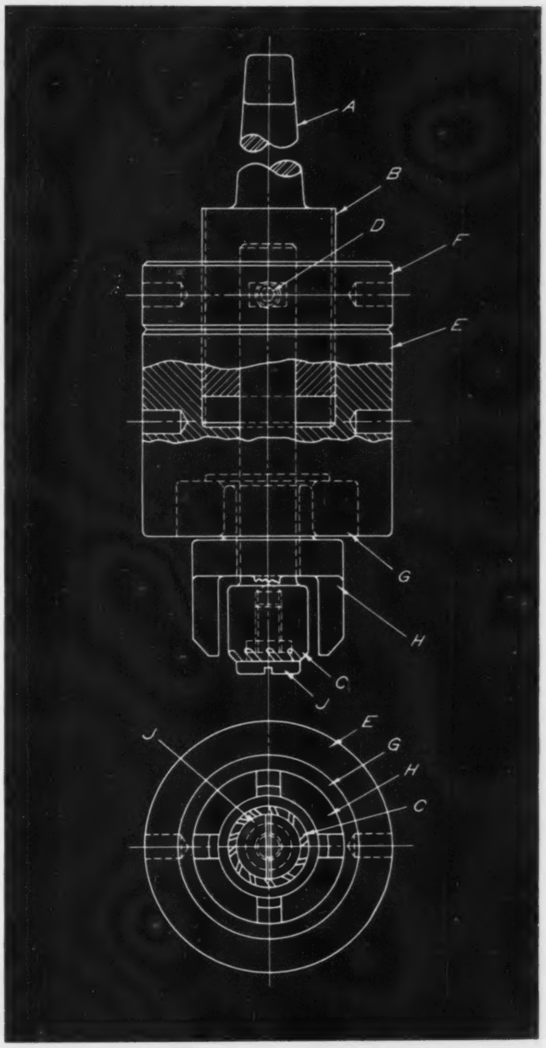
clined at a lesser angle. The crest is rounded, polished, and heat-treated to withstand the impact to which it will be subjected.

A similar integral node N is provided on the upper end of the sleeve. Although both sides of this protuberence are inclined at an angle of 45 degrees, its height and width are the same as for node M. Radial locations from the center of the spindle must be identical for both. The lower end of rod F is bored to receive the round shank of rivet-set O. A cross-pin holds it in place.

Before using this unit, cap D should be removed and an ample quantity of grease stuffed into the body around the revolving spindle and the reciprocating members. Grease seal P prevents the escape of lubricant through the nose of the device.

In operation, the tapered shank of the tool is inserted into the drill press spindle just as would be done with any tapered-shank twist drill. Because body A must remain stationary, an arm Q is screwed into a blind tapped hole in the body wall and braced against the machine frame. The machine table is then adjusted to the proper height.

When the drill press is started in the normal direction of rotation, spindle B will be driven in the direction indicated by the arrow. Once during each revolution of the spindle, node M will strike node N. As a result of this, sleeve E and rod F will be driven sharply downward. The sleeve and rod will move 3/8 inch when the tool is set for its maximum stroke. After the upper node has passed this point, the return spring will once again raise the sleeve and rod to their original positions. Optimum operating conditions may be realized within the speed range of 200 to 250 R.P.M.



Countersinking tool is provided with an adjustable stop for positive depth control.

Countersinking Tool Combined with an Adjustable Stop

By John K. Korra, Indianapolis, Ind.

When large quantities of parts require countersinking, the problem of accurate depth control often arises. This may be simply met by the tool illustrated, having a positive self-contained depth stop.

Integral with tapered shank A is a cylindrical body B. Fine-pitch threads are cut around the periphery of the body portion. A blind hole is drilled into the threaded body along its longitudinal axis to receive the straight shank of countersinking tool C. The tool is held in place by two set-screws D that bear against flats machined in its shank.

Threaded on B are stop-body E and lock-nut F, both members being provided with spanner holes. A roller thrust bearing G is pressed into a counterbore in the lower face of the stop-body. The shank of stop H is pressed into this bearing and is free to turn with it. The countersinking tool turns freely within both the stop-body and the stop.

The head of screw J which is threaded into a tapped hole in the cutting end of the tool, serves as a pilot. A shoulder on this pilot screw fits within a comparatively deep counterbore, thus providing ample clearance for tightening in the event of tool grinding.

In operation, the desired depth is set by backing off lock-nut F and adjusting the stop-body to obtain the proper distance from the bottom of the cutting edge to the lower surface of stop H. The pilot is then located in the hole to be counter-

sunk, and the tool advanced. When the required depth has been reached, the stop will contact the surface of the work, thus halting the progress of the countersinking tool.

Multiple-Spindle Milling Head

By DWIGHT D. WELLS, Hamilton, Ohio

A multiple-spindle head applied to the spindle of a horizontal boring, drilling, and milling machine permits the simultaneous operation of three end-mills. The device, seen in the accompanying illustration, was developed for a press manufacturer to machine T-slots in bolster plates too large to be handled on the milling machines available in the plant.

A mounting plate *A* is doweled and screwed to the end of the machine spindle. The welded housing *B* is permanently fastened to an adapter *C*. Two locating pins *D* in the adapter engage corresponding holes in the plate, aligning the head properly when mounted.

Within the housing, three auxiliary spindles *E*, *F* and *G* are arranged in tandem. Each spindle is borne by a tapered roller bearing *H* at the driving end and a ball bearing *J* near its rear end. The drive from the machine spindle *K* is transmitted through a floating coupling *L* to the central auxiliary spindle *F*. A gear *M* fitted around this spindle meshes with an identical gear around each of the other two auxiliary spindles *E* and *G*. Thus, the central spindle drives the two other spindles in a reverse direction.

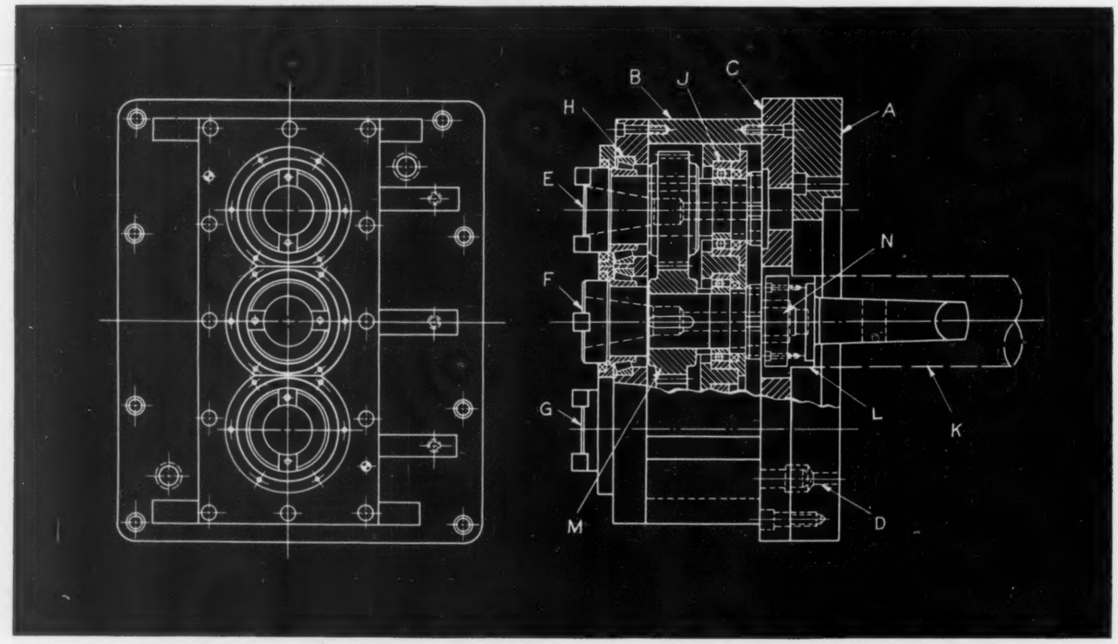
All three spindles have American Standard tapers, and accommodate stock cutter-arbors. Draw-bolts *N* secure the arbors in the spindles. In use, spindle *F* carries a left-hand end-mill, and spindles *E* and *G* carry right-hand end-mills, since the machine spindle runs clockwise (as viewed looking toward the spindle).

* * *

Society of Die Casting Engineers Formed

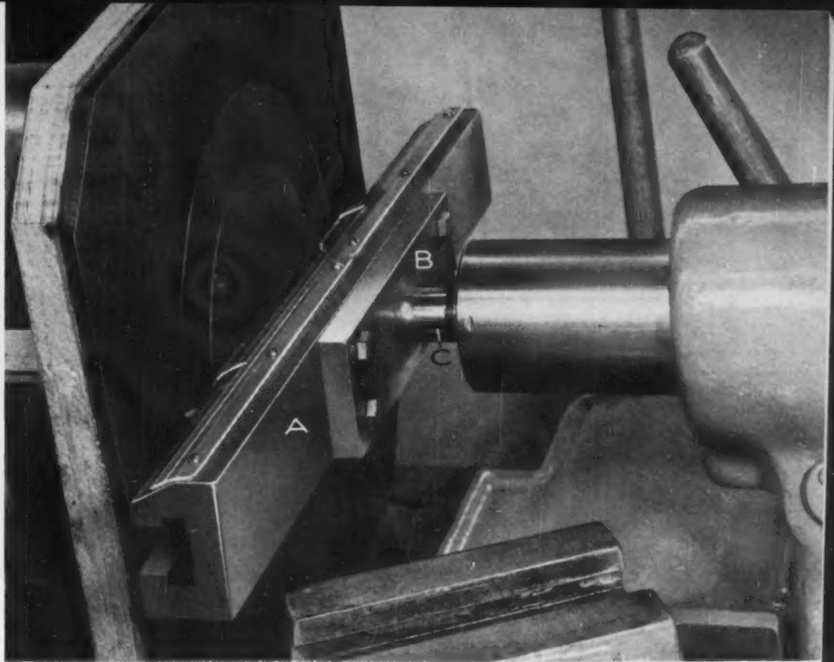
A new technical society, named the Society of Die Casting Engineers, has been formed to foster and further technological advances in the fields of die-casting and finishing of metals, and die-molding of plastics and powdered metals. The main objective of the new society will be the exchange, accumulation, and dissemination of the latest information and knowledge in the science of die-casting and related arts. A major aim is the development of modern standards for the die-casting industry.

The first chapter to be formed within the new organization is the Detroit No. 1 Chapter. Membership in the Society is open to those whose business activities relate to die-casting, die-molding, finishing, and related arts. The new society's national headquarters and offices will be at 19370 James Couzens Highway, Detroit 35, Mich.



This multiple-spindle head permits the simultaneous milling of three T-slots in work set up on a horizontal boring, drilling, and milling machine.

Ring Gaskets Cut with Lathe Attachment



By Charles F. Bullinger
Engineering Supervisor
Central Shops Department
Argonne National Laboratory
Lemont, Ill.

RING gaskets of rubber or plastic can be accurately and quickly cut with a simple attachment for a lathe tailstock. Cutting elements of the attachment are two knives contained in a T-slot bar *A*, Fig. 1. The back of this bar is bolted to a flange piece *B*, which, in turn, is welded to a discarded drill shank *C* having a taper corresponding to that of the tailstock spindle socket. This attachment cuts gaskets up to 15 inches outside diameter and 1/2 inch thick.

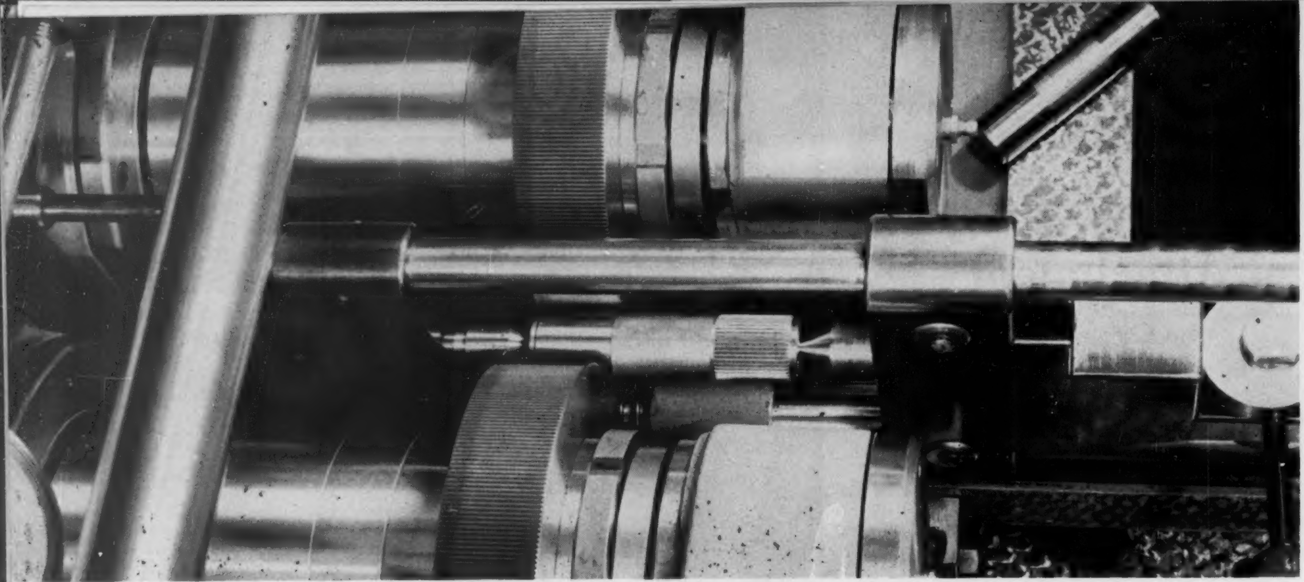
Each knife *K*, Fig. 2, is held in a T-nut *D* in the face of the bar slot. These nuts can be fixed along the slot by means of set-screws *E*. Pointers *F*, directly above the knife edges, register over two half-size metal drafting scales *G* fastened to the top of the bar. The scales are butted together on the center line of the lathe. By using the half-size scales, the pointers give a direct reading of the desired outside and inside diameter on opposite ends of the bar. Adjustment of the diameters to 1/64 inch is possible.

The gasket material is secured with a double-backed plastic tape to a 1/2-inch thick piece of plywood that is held in the lathe chuck jaws. (All powder or oil should be removed from the face of the material adhering to the tape.) After the gasket is cut, the tape is stripped from the plywood with the scrap, and another piece of material is applied.

Ring gaskets of practically any size and thickness can be cut in this fashion. The limiting factors are the swing of the lathe, the length of the T-slot bar, and the length of the knives. By adapting the attachment to drill-press spindles, a larger range of work sizes can be handled. The attachment was developed by Oscar Wittlinger of the Central Shops Department, Argonne National Laboratory.

Fig. 1. (Above) Two knives on opposite ends of the T-slot bar (*A*) cut out the ring gasket.

Fig. 2. (Right) The double-backed tape for securing the gasket material can be seen in the area from which the ring has been stripped.



Achievements in Precision Thread- and Spline-Rolling

STRONG, accurate threads and splines of excellent finish are being produced at high production rates by a chipless, cold-forming process on "Lanhyrol" thread-rolling machines recently developed by the Landis Machine Co., Waynesboro, Pa. These machines are of the two-roll (cylindrical thread die) design. The work blank is supported in the rolling position between the rolls on a work-rest blade or holding fixture.

The two thread-roll dies are mounted on parallel horizontal spindles which are power driven. One roll and its spindle rotates in a stationary bearing support. The opposing roll and spindle unit rotates in a movable bearing support housing controlled by variable hydraulic pressure.

The machine shown in Fig. 1 is powered by a 7 1/2-H.P. two-speed motor with a V-belt drive to the speed-change gear-box. Splined drive-shafts and heavy-duty universal joints connect the speed change-gear unit with the final drive mechanism in the spindle housings. The final drive to each of the roll spindles is accomplished through a heavy-duty worm and worm-wheel speed reducer that delivers power through a pair of helical gears.

The speed change-gear unit provides sixteen spindle speeds, ranging from 14 to 126 R.P.M., through the use of four pairs of pick-off change-gears. Special gears can be furnished for higher and lower speeds when required. The hydraulic operating cylinder, which actuates the right-hand spindle housing is machined from bar steel to insure high strength and maximum rigidity.

With suitable rolls, the machine will produce left- or right-hand threads of all types from 3/16 inch to 3 inches in diameter, with the exception of square threads and threads of high taper. When using the high production continuous rolling method, the machine will produce threads to Class 2 and 3 thread-fit tolerances. Tolerances up to and including Class 4 can be maintained by the infeed, through-feed, and reciprocal rolling methods.

UN form threads ranging in pitch from 5 to 32 threads per inch, Acme threads of 6 or more threads per inch, and worm threads equivalent to 8 diametral pitch and finer can be produced under normal conditions. However, maximum pitch limitations will vary as they are dependent on the flow characteristics, elongation value,

Fig. 1. "Lanhyrol" thread-rolling machine developed by the Landis Machine Co.

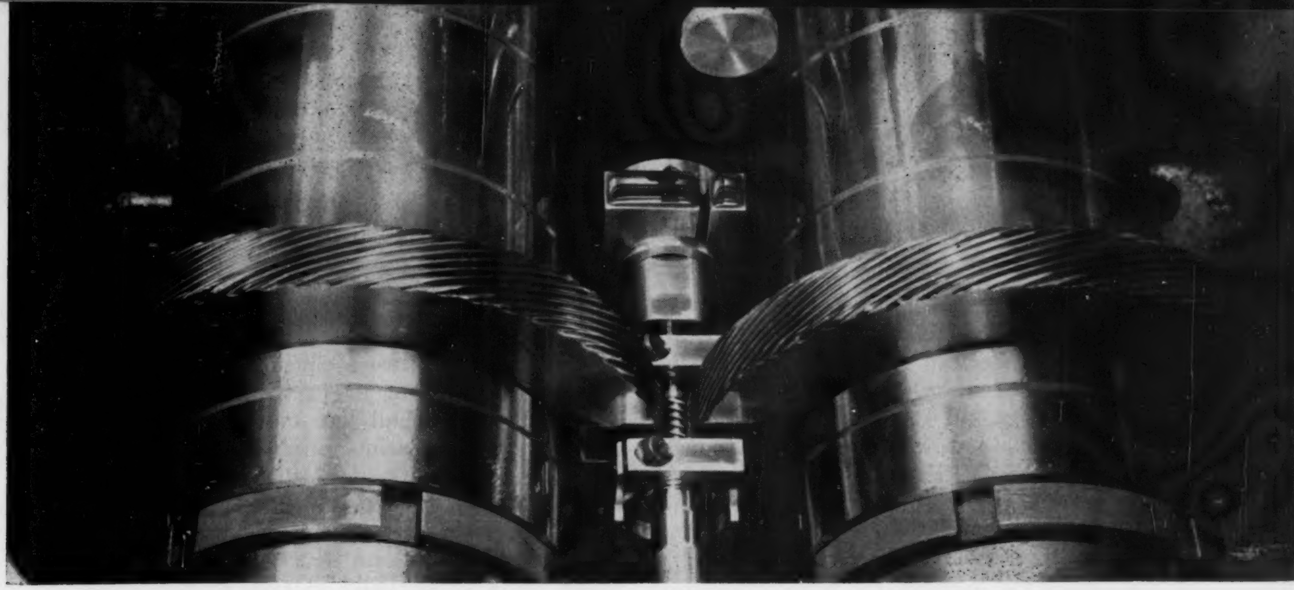


Fig. 2. Close-up of rolls used on machine shown in Fig. 1 for rolling worm thread

tensile strength and hardness of the work-piece. Threads can also be rolled on hollow, extremely long and odd-shaped parts through the use of auxiliary equipment.

The infeed, or plunge-rolling, method—in which the movable die is fed to and from the work-piece—is generally used where a thread length of 5 7/8 inches or less is required. Continuously threaded roll dies are used on both spindles as shown in Fig. 2. The work-piece is placed on the work-rest, blade or work-holding fixture with the right-hand roll and its movable housing in a retracted position. The desired thread diameter is produced as the machine cycle advances the right-hand roll to a predetermined distance from the left-hand roll and spindle unit.

A left-hand single-thread worm of 26 diametral pitch, 1/4 inch in diameter and 3/4 inch in length is rolled in a stainless-steel transfer drive worm by the roll dies shown in Fig. 2 at the rate of 20 parts per minute using the infeed method.

In addition to thread-rolling, the Lanhyrol machine can be equipped with rolls (as shown in the heading illustration) for splining or rolling serrations in steel shafts. In this case the machine rolls 48 serrations 1 1/4 inches in length on a shaft 1 inch in diameter at the rate of 6 ends per minute. These shafts are made from 1020 steel.

In this application the work-piece is held between centers in the work-holding fixture. The section of the fixture that contains the centers is mounted in a slide so that it can be withdrawn from the rolling area.

A completely automatic operation can be employed for many jobs by providing the machine with such work-handling equipment as hoppers, feed-chutes, and feed-magazines. For example, threads are rolled on mine bolts at a production rate of 7 bolts per minute on a machine equipped as shown in Fig. 3. These bolts are made of 4140 steel of 300 Brinell hardness. They are 7/8 inch in diameter, 1 3/8 inches in length and have 9-pitch Class 2 and 3 tolerance threads.

The mine bolts are delivered from the hopper into a feed-chute and then to the revolving, cage type work-rest. The work-rest cage, which encases the left-hand roll, indexes the bolts into and away from the rolling position. Indexing is timed, through a "load and fire" mechanism to synchronize with the rearward movement of the right-hand spindle unit as it returns to the loading position after each piece is threaded.

Machines can be equipped to roll the threads on both ends of a part simultaneously. Also they can be set up for through-feed continuous rolling of threads on rods of any length desired.

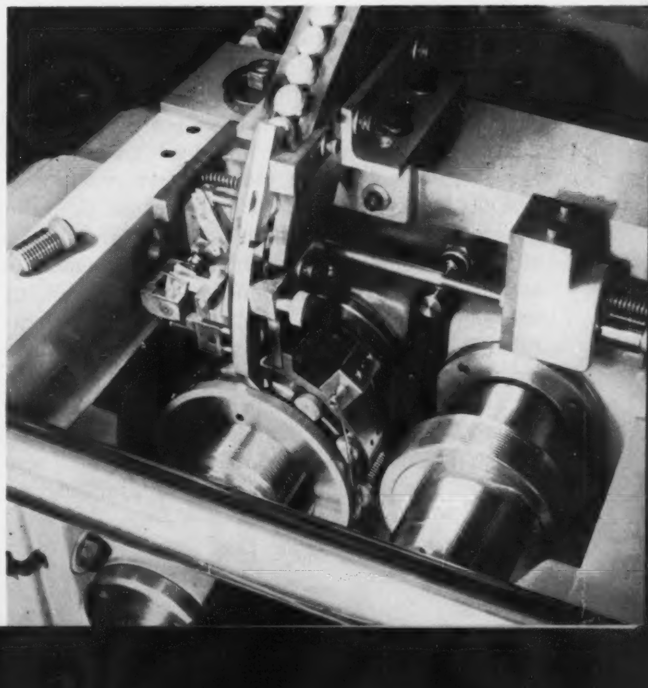


Fig. 3. Close-up of thread rolls and automatic feed used on "Lanhyrol" thread-rolling machine

Machine Tool Distributors Stress Better Selling

THEME of the thirty-first Spring Meeting of the American Machine Tool Distributors' Association, held recently at White Sulphur Springs, W. Va., was "better selling." Two panel discussions were featured at the meeting: one presented the views of panel members on the selection, training, and introduction of new salesmen; and the other covered methods and controls in office management.

In opening the meeting, the Association president, R. A. Vidinghoff, president of Machinery Associates, Inc., Wynnewood, Pa., said, "A large segment of our industry depends upon the machine tool distributor for the proper sale and service of machine tool equipment. The metal-working industry looks to the machine tool distributor for recommendations that will cut costs, create a better product . . . and at the same time give us increased capacity for defense."

A note of warning against "current tendencies to play politics with the nation's business and economic interests" was sounded by Thomas R. Rudel, president of the Rudel Machinery Co., New York City. He said, "Events in Washington have made this a period requiring considerable vigilance. Almost continuously there have been efforts to promote and pass legislation of strong political flavor aimed at industry. Acting from what they assume to be political pressure, a number of legislators have been guided not by the welfare of business but by the welfare of politics." Two such instances concern efforts to weaken gains made in accelerated depreciation and reserves for future expenses.

Industry's need to replace its obsolete and worn out machine tool equipment was stressed by principal speakers representing the industry. Mr. Vidinghoff said that of about two million machine tools installed in the metal-working industry, more than four hundred thousand of these are twenty years old and that over a million are ten years old. He pointed out that the government's liberalized policies toward depreciation provide a "real incentive" to machine tool users to modernize, and that the replacement market is the reason that the machine tool industry can be kept working at capacity for a long time to come.

Milburn A. Hollengreen, president of the National Machine Tool Builders' Association and of the Landis Tool Co., Waynesboro, Pa., also stressed the obsolescence of the major portion of the metal-working equipment of the United States in his address, "Spending for Profit." He said: "Those of us in the industry must realize that we shall lose our industrial pre-eminence if we continue on and on 'wearing it out and doing without.' Nobody today in the metal-working industry can stand the cost of not having modern, efficient machines."

Mr. Hollengreen said that tool improvements mean little to financial officers of companies unless they can be translated into financial savings. He cited the following advantages of modern machine tools in terms of financial interest:

1. Reduced direct labor costs, or conversely, increased output per man-hour.
2. Reduced overhead.
3. Improvement of product to gain competitive advantage or in new products to gain diversification.

Tell Berna, general manager of the National Machine Tool Builders' Association, told the meeting that it is difficult, at the present time, to predict the immediate future for the industry. He said that following recent advances in sales, the industry has maintained a plateau in volume. During the coming year, he felt that one of the chief areas of progress will be found in the replacement market. He said, "No matter how we approach the problem, we keep coming back to the individual salesman, whose job it is to show the man running the shop the profits he is losing because of old equipment."

Repeated references were made by speakers at the meeting to the forthcoming Machine Tool Show to be held in Chicago, Ill., at the International Amphitheatre, September 6 to 17, with a Production Engineering Show of accessory equipment at the Navy Pier on the same days. In a report on the activities of the Association's Machine Tool Show Committee, chairman Frank H. Habicht, vice-president and general manager of Marshall & Huschart Machinery Co., Chicago, Ill., predicted a tremendous interest. He said, "When we consider that wages have gone up much faster than machine tool prices, it is evident that the modern machine tool is a greater bargain than ever. Our industry is in position to make good deliveries. Metal-working plants face a period of intense competition, and they have an enormous accumulation of machine tools that could be replaced at a profit."

Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Is the Home Sales Team Well Organized?

RECENTLY a letter was received from a small machinery builder which can be condensed as follows: "Our problem is how to organize our sales department. The products sold are diversified, and no one person can do all the different jobs. I am asking for information that will help establish a headquarters organization that will operate efficiently."

This letter, with others received, points out a pressing need for better organization at headquarters—especially in the case of the smaller machinery builder. Larger companies can afford to specialize and to have a man for each duty. It is not possible with smaller companies, for often more than one responsibility must be assigned to a man.

Since it is difficult for a small company to make sure all sales responsibilities and duties are adequately met, the following is a guide for sales managers:

1. Market analysis—present and probable future product demand, broken down by territories and major industries.
2. Sales promotion—advertising, promotional literature, and displays.
3. Salesmen's working material—technical data, prices, and delivery schedules.
4. Sales quotas and performance records by product, territory, industry, and salesmen.
5. Preparation of specifications, prices, and delivery information for use by salesmen on important, individual current jobs; answering miscellaneous inquiries.
6. Direction and control of field sales.
7. Contact with design engineers on product improvements and new developments.
8. Contact with manufacturing personnel on volume production, schedules, and inventories.
9. Service in entering, processing, and following-up orders.
10. Selection and training of salesmen.

With competition increasing, there has been a growing tendency to fix responsibility at headquarters for directing sales activity along product lines, rather than by industry or individual customer. Product improvement and expert knowledge of the product and its application are increasingly necessary. Large companies recognize this need in order to serve customers well and meet the competition of single-product manufacturers.

Let us take the case of a small equipment builder who sells three allied product lines. To simplify our analysis we will assume it has seven men at headquarters:

1. A general sales manager, who directs both the headquarters and field sales organization, dividing his time accordingly. He also selects, trains, and stimulates all sales personnel, and defines duties and responsibilities.
2. A market research man, who analyzes sales potentials. He also maintains sales records and establishes sales quotas.
3. A sales promotional man in charge of advertising, literature, displays, and working material for the salesmen.
4. Three men assigned to different product lines; each responsible for product improvement and development of new ones. They study competition, see that field salesmen are informed and activated, and keep in direct touch with design engineering and shop production.
5. A contact manager, who prepares important proposals for groups of equipment. He is also responsible for the entry and following of all orders.

This organization is given in skeleton form. It can, of course, be expanded and subdivided according to the size of the company.

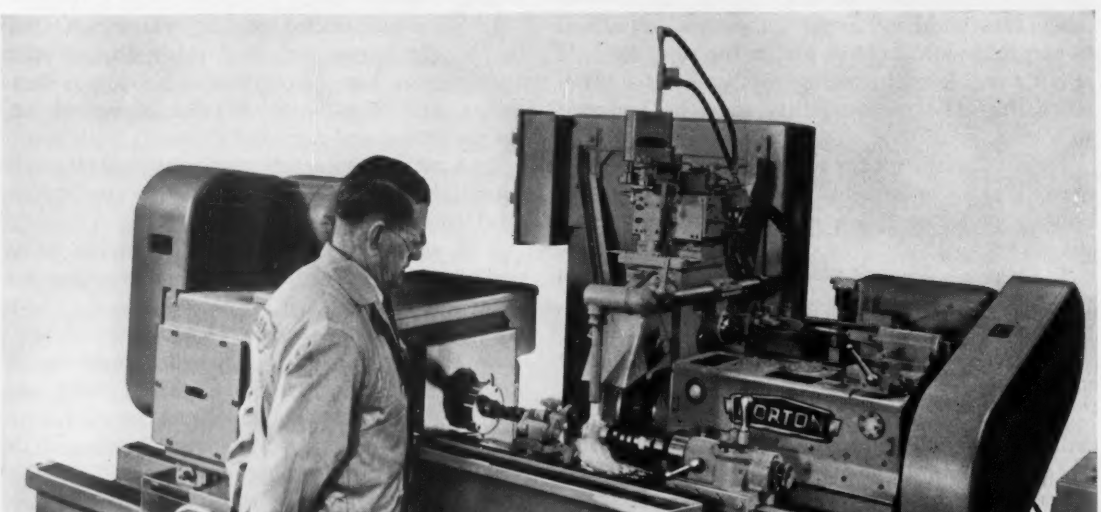
The sales manager of the smaller equipment manufacturer in his concentration on salesmen and selling, frequently disregards organizational plans. As a result, the sales department often grows into a state of malformation. Valuable functions escape attention, and responsibilities and duties are not clearly defined. Every sales manager should set a pattern for growth, and re-evaluate this from year to year.

LATEST DEVELOPMENTS IN *Shop*

Norton Precision Cam-Grinding Machine

An automatic precision cam-grinding machine known as the No. 3 "Cam-O-Matic," has just been announced by the Norton Co., of Worcester, Mass. Faster grinding of automotive type cam-shafts and a better surface finish on the work are among the advantages claimed for this new machine. Features designed to obtain more accurately formed cams with a finer finish include simplified but sturdier construction and a positive work drive. The Gilmer timing belt used to obtain smooth work rotation by eliminating slippage is said to require less power than the drives previously employed.

The No. 3 Cam-O-Matic has two automatically controlled work-speeds. The higher speed is adjusted for the optimum rate of stock removal while the slow speed is selected to give the most accurate contour and the finest finish. The change from the fast to the slow speed is automatic and its timing can be easily adjusted by a simple setting of a small



Precision cam-grinding machine announced by the Norton Co.

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

lever which is located on the wheel-feed mechanism.

The grinding action has been improved through the use of a heavier one-piece rocking bar of substantially increased cross-sectional area. A tapered roller bearing supports the center of the rocking bar. This increased rigidity combined with the new and sturdier sliding and swivel tables of the machine permit heavier wheel feeds and consequently result in work having a more accurate contour.

Another feature of this machine is automatic wheel-guard truing. The truing cycle commences automatically after the last cam or eccentric has been ground, regardless of the angle of the wheel slide. Since the truing mechanism is built into the wheel guard, there is no swiveling of the wheel-head prior to truing when grinding tapered cams. The mechanism for automatic compensation for wheel wear is built into the new camshaft grinding machine.

Circle Item 101 on postcard, page 253

Adamas Special Premium Carbides

Adamas Carbide Corporation, Kenilworth, N. J., has developed four special grades of carbide for applications involving difficult machining operations. Grade 434 is intended for roughing cuts on steel, including interrupted cuts, when heavy feeds are used. Grade 548 is hard, yet strong, and is intended for finishing cuts. This grade is capable of withstanding considerable shock. A Grade GG has been developed for interrupted cuts on steel where extreme shock and vibration are encountered. Grade 474 has good shock resistance and greater wear resistance than Grade GG.

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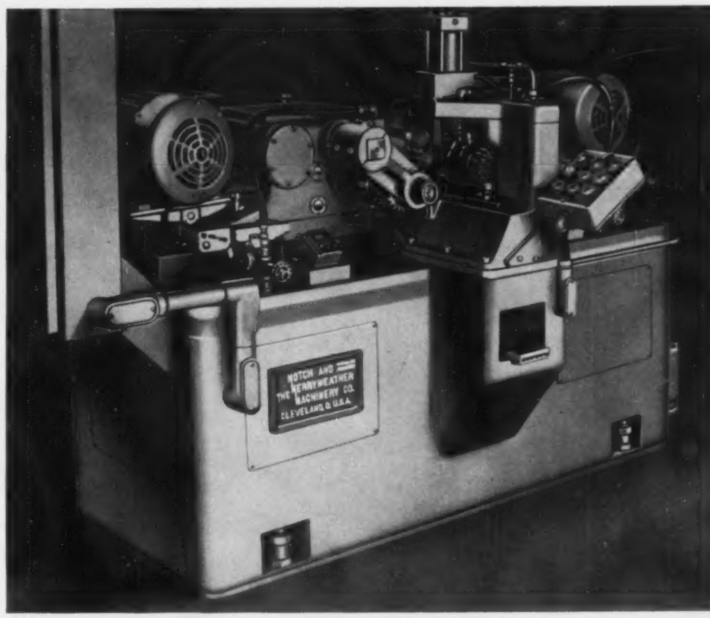

Motch & Merryweather connecting-rod processing machine

Duplex Machine for Milling Bolt Seat and Splitting Cap of Connecting-Rods

A duplex machine for milling bolt seats and splitting the cap of one-piece forged connecting-rods has been built by the Motch & Merryweather Machinery Co., Cleveland, Ohio. This machine has a circular saw which cuts the cap from the connecting-rod at the crankshaft end while the top and bottom bolt seats are being finish-milled. The single arbor on each head has a Triple-Chip circular saw blade mounted between straddle-milling cutters for simultaneous cutting and milling operations.

The machine consists primarily of right- and left-hand traveling milling heads mounted on steel ways. Each head has arbor supports for the saw blade and straddle-milling cutters. The heads approach the work simultaneously, and the area comprising the crank end of the connecting-rod is cut in half and milled from two sides at the same time.

The part is located in the fixture by placing the machined pin end over a hardened and ground pin with hardened steel blocks providing location at the crank end where the sawing and straddle-milling operations are performed. Clamping is accomplished by a hydraulic cylinder over the top of the forging at the crank end. In removing the machined and split rod, the operator raises the shank end from the pin, pushing the cap into a chute for ejection at the front of the machine.

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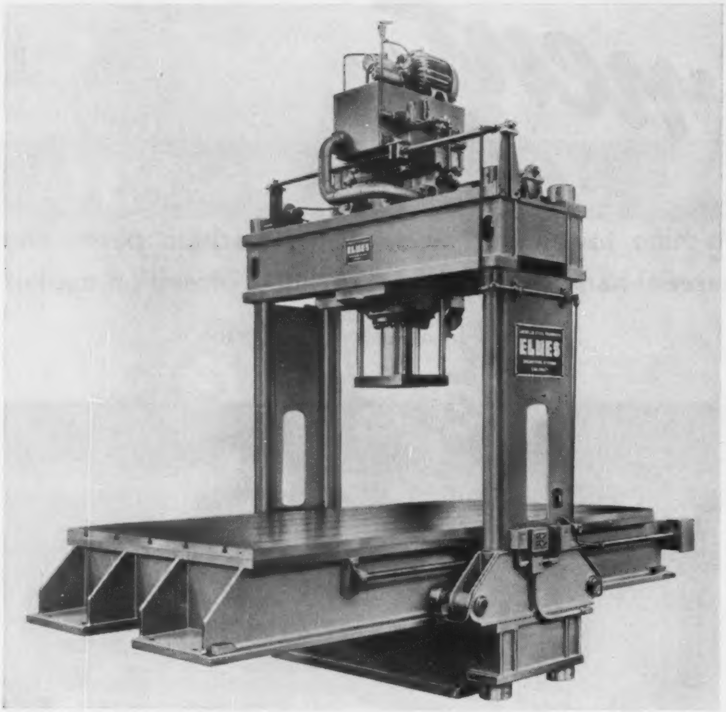
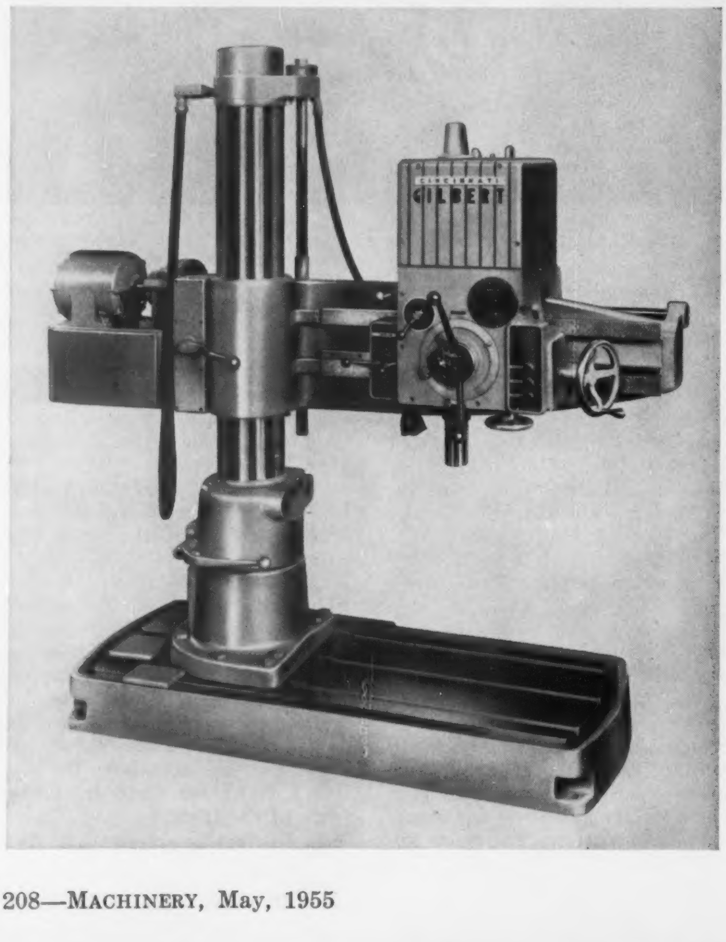


Elmes straightening press with two-way traveling head announced by American Steel Foundries.



Elmes Straightening Press Equipped with Two-Way Traveling Head

Elmes Engineering Division of American Steel Foundries, Cincinnati, Ohio, has announced a hydraulic straightening press having a stroke of 24 inches and a capacity of 400 tons. This press is equipped with a two-way traveling head and has been especially designed for straightening large weldments and castings.

The press consists of a large one-piece welded bed with removable bolster plate; a welded-steel bridge for supporting the traveling cylinders and power unit; two welded-steel side housings containing the four columns and steel rollers; and a welded-steel yoke that passes under the bed and receives one end of each of the four pre-stressed columns. The total weight of the traveling unit is supported on four steel rollers that travel on tracks, one on each side.

The ram is fitted with a guided platen on which the straightening fixtures are mounted. The platen travel of 144 inches along the bed is provided by two lead-screws. The pressure cylinder has a total movement of 60 inches across the bed. This movement is obtained by means of one lead-screw. The lead-screws are controlled by reversing drum switches. A hand-lever gives precise control over the ram travel. Limit switches deactivate the lead-screw drive motors when the limit of travel has been reached.

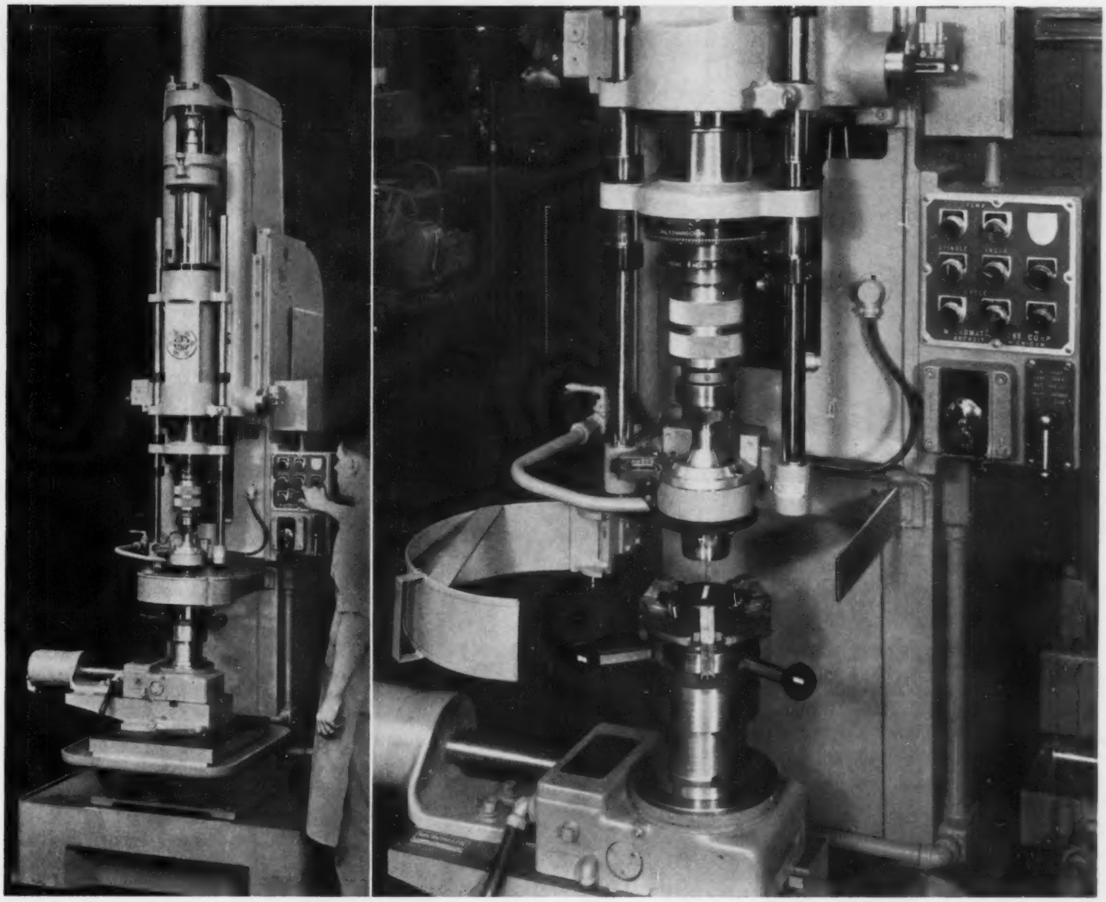
Circle Item 104 on postcard, page 253

High-Speed Light-Duty Radial Drilling Machine

A 3-H.P. light-duty radial drilling machine with an exceptionally high spindle-speed ratio is announced by the Cincinnati Gilbert Machine Tool Co., Cincinnati 23, Ohio. Three ranges of spindle speed are available on this machine: 40 to 1600; 50 to 2000; and 80 to 3200 R.P.M. Twelve changes in spindle speed are provided by means of alloy-steel sliding gears mounted on ground integral multiple-splined shafts in the head.

The machine is equipped for automatic reversal of the spindle.

Radial drilling machine with high spindle speeds announced by the Cincinnati Gilbert Machine Tool Co.



(Left) Hydrohoner Model 728 built by the Micromatic Hone Corporation. (Right) Close-up of work held in the fixture of machine shown at left.

Both the spindle and its sleeve are counterbalanced.

The head is mounted on the radial arm by means of two dovetail slides, but its weight is carried on adjustable ball-bearing rollers which operate on a hardened and ground way. The standard feed mechanism has four feeds: 0.003-, 0.007-, 0.011- and 0.015-inch per revolution.

A safety device makes it impossible to raise or lower the arm while it is clamped. Moving the lever to its central position locks the arm securely to the column. The arm stops automatically when it reaches either the top or bottom of the column. It also stops automatically if any part of the head or arm should hit an obstruction when the arm is being lowered. A wide variety of bases, including runway or rail mountings, can be furnished with this machine, which is built with 3- or 4-foot arms and a 9-inch column.

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Spline Honing Machine

A Model 728 "Hydrohoner," designed for a broad range of honing operations, is being built by the Micromatic Hone Corporation, Detroit, Mich. One adaptation of this model is used for honing splines in hardened gears. The straight and round bearing surfaces of the splines are generated concentric with the pitch circle of the teeth, and have a finish that will not gall the shaft. Previous to the adoption of honing, it had been necessary to anneal the spline surfaces before the final machining operation. This resulted in soft bearing surfaces which made it difficult to fit the shafts to the gears in 0.0002-inch increments because the soft surface tended to pick and gall the shaft. Microhoning solved this problem as hardness does not affect honing.

In conventional honing jobs, the tool is rotated as it is reciprocated through the bore. To hone splines, the tools are designed with a stone for each spline, the stone being about half as wide as the spline. Rotation is replaced by an oscillating motion. The stone is swept across the spline as the tool is reciprocated. To obtain full surface coverage by all the stones, the part is indexed periodically.

The Hydrohoner shown in the illustration is equipped to process forged steel gears of 58 to 60 Rockwell C hardness. It removes 0.002 to 0.006 inch of stock on the diameter, holding out-of-roundness and taper to limits of less than 0.0003 inch. Finish is 15 to 20 micro-inches r.m.s. The size is held with sufficient accuracy to permit the shafts to be fitted easily with a minimum clearance of 0.0002 inch. The machine has a cycle time of 35 to 40 seconds per gear and turns out 350 to 450 gears in an eight-hour shift.

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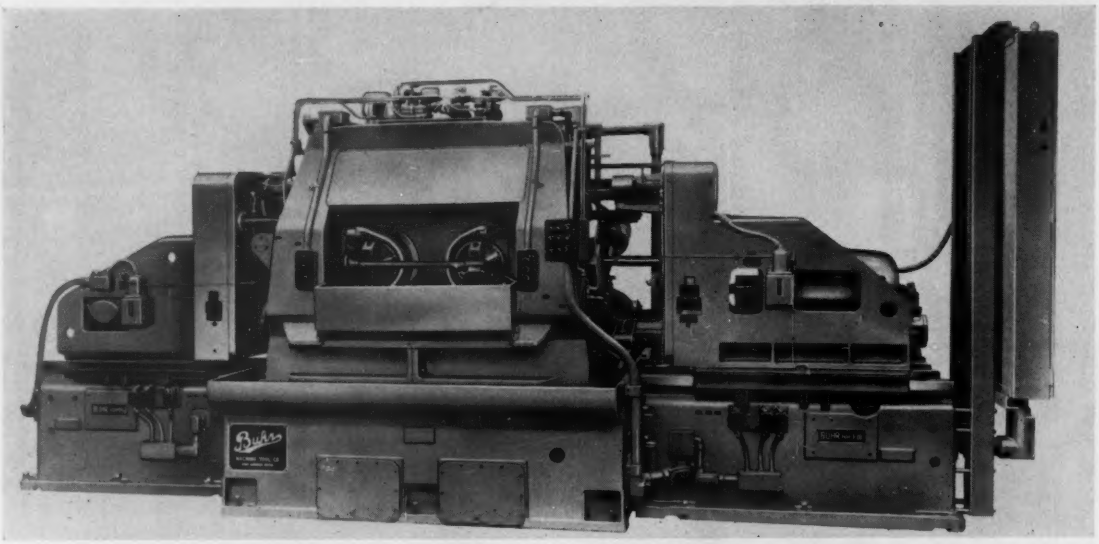

Special trunnion type machine for processing rear-axle shafts built by the Buhr Machine Tool Co.

Buhr Trunnion Type Special Machine for Processing Rear-Axle Shafts

Three trunnion type special machines like the one illustrated, each capable of processing 147 rear-axle shafts an hour at an operating efficiency of 80 per cent have been built by the Buhr Machine Tool Co., Ann Arbor, Mich., for a large automotive manufacturing company. Each of these two-way horizontal hydraulic-feed special machines is equipped to center-drill both ends, drill two 1/2-inch holes in the large end, and face the small end of a rear-axle shaft.

These machines have multiple heads of the master gear-box construction type with individual pot heads at the working stations, as well as pot heads which carry individual bushing plates that register in the fixture at each working station. Each of the three machines has a three-station single-place trunnion type holding fixture arranged with automatic indexing and automatic clamping by means of two power wrenches which operate two self-centering chucks.

All parts of the machines are held to close tolerances and are completely interchangeable. Each component assembly is located by dowels in precision-bored holes. Other features include: electrically controlled automatic indexing of the cam-and-roller type designed to guarantee uniform acceleration and deceleration of the indexing movement; hardened and ground laminated tool-steel ways which are automatically lubricated; and multiple heads of ball-bearing construction with shaved gears and broached and splined drives.

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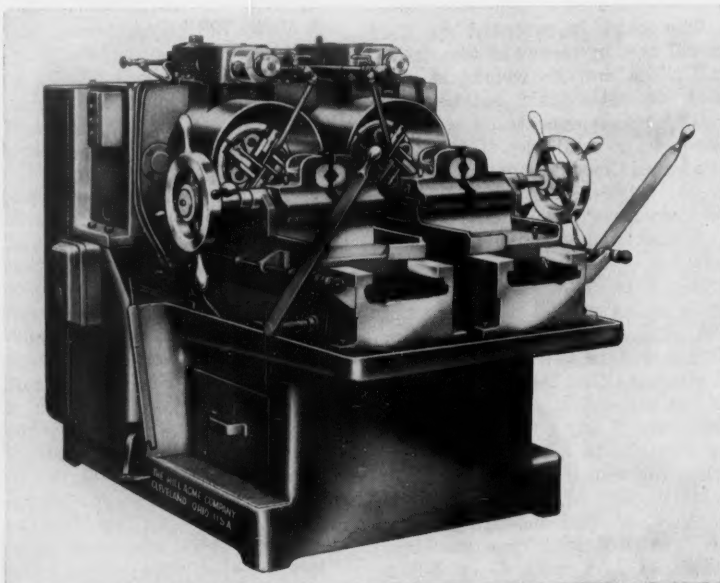
Acme Threading Machine

The Hill Acme Co., Acme Machinery Division, Cleveland, Ohio, has brought out a Model XLA threading machine which can be equipped to meet the varied requirements of both plant maintenance and high-speed accurate production work. It can be adapted for threading bolts, pipe, studs, as well as for hollow-milling and pointing operations. Tooling for all standard thread forms is available from stock in a complete range of sizes.

This machine is manufactured in single- and double-spindle designs and 1-, 1 1/2-, 2-, and 2 1/2-inch capacity sizes. The large



Double-spindle threading machine announced by the Hill Acme Co.

coolant reservoir is covered by a screen and the removable chip drawer has a sturdy screen bottom which permits rapid return of the coolant. The ground spindle is bored to allow the threaded stock to pass through it, so that, by regripping the work, it is possible to cut threads of any length. Special bed lengths can be furnished.

Double-spindle machines are equipped with a separate motor and starter for each spindle. Thus each spindle can be operated at maximum efficiency for the stock being threaded. By using a reversing starter, left-hand threads can be generated by one spindle while developing right-hand threads with the other spindle. Down time on one spindle of the double-spindle machine does not prevent production from continuing on the other spindle.

Starting, jogging, stopping, and direction of spindle rotation are electrically controlled by a push-button station. A variety of optional equipment is available, including a lead-screw for use where extremely accurate threads or extra-heavy cuts are required. A mechanically controlled die-head, internal trip, electrically operated gripper jaws, multiple-pass threading device, reaming and chamfering attachment, and automatic air-powered carriage return are among the other attachments available as optional equipment.

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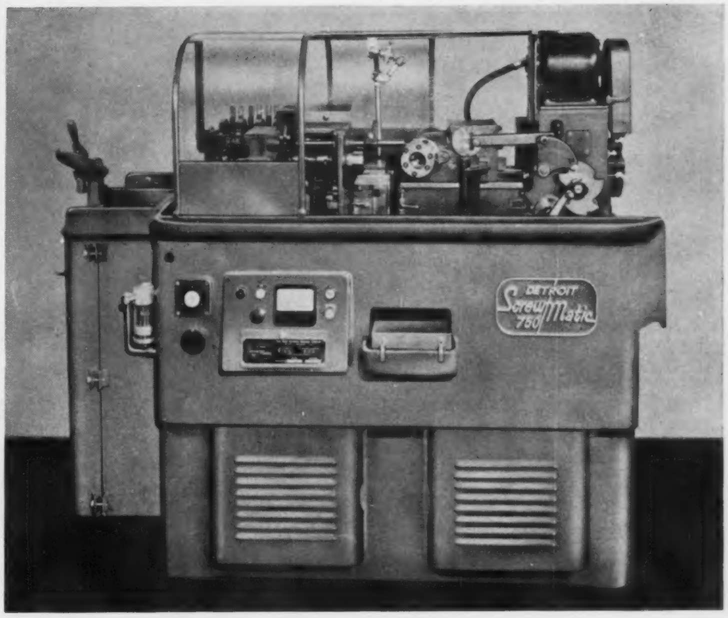

Fig. 1. Detroit Screwmatic single-spindle automatic screw machine

Detroit Single-Spindle Bar-Stock Automatic Screw Machine

The Gear Grinding Machine Co., Detroit, Mich., has brought out a Detroit Screwmatic 750 single-spindle, bar-stock automatic screw machine which handles all types of bar stock with outside diameters up to 0.750 inch. It is equipped with a heavy-duty, 5-H.P. motor and has a range of speeds adapted for machining all types of materials with carbide tools. The spindle speeds are infinitely variable and provision is made for the use of three different forward speeds during any work cycle. Because all speeds are reversible, the need for left-hand tools for this machine is eliminated.

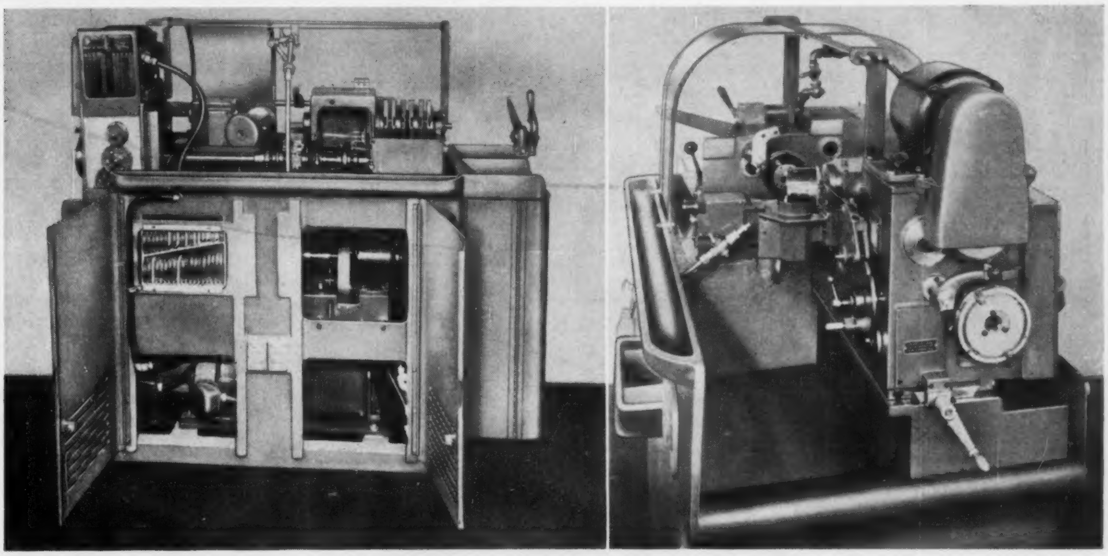

Fig. 2. (Left) Open back view of Detroit Screwmatic showing accessibility of cycle time gearing, automatic lubrication unit and coolant pump drive. (Right) View of deep chip well with open end provided on Screwmatic to facilitate removal of chips while machine is in operation

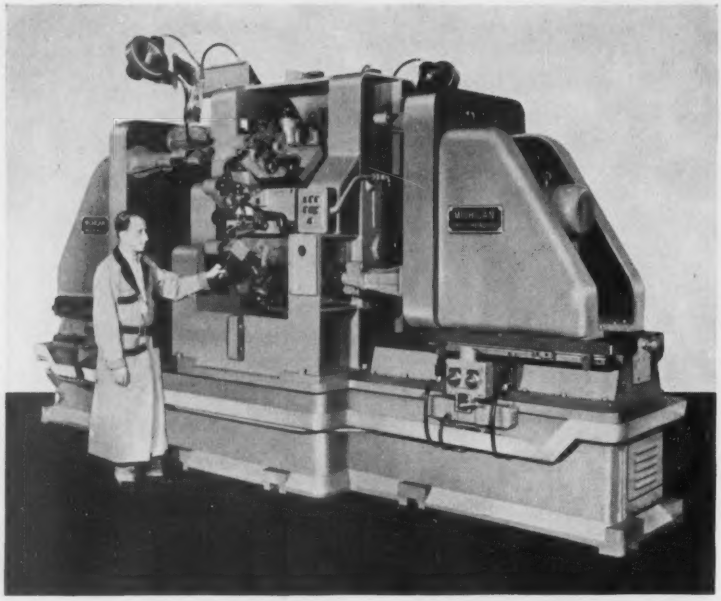

Fig. 1. Trunnion type automatic indexing, double-end drilling and assembling machine built by Michigan Drill Head Co.

A slidable turret unit increases the work length capacity by several inches and a three-position crank permits long, medium, and short work to be produced with equal efficiency. A six-position turret is provided for end-working tools. The short stubby spindle is mounted in precision non-adjustable, anti-friction bearings which carry no belt load.

Retooling for a new job is quickly and easily accomplished. Tool and cam lay-out computations are said to be greatly simplified by the open front, high-wall cabinet, immediate tool accessibility, and large tooling space. Standard tools, cams, collets, and accessory equipment are used throughout the machine to adapt it for a wide range of work.

Work chips flow into a large, deep chip well with an open end which permits them to be removed from the machine during actual operation.

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Automatic Machines and Equipment for Processing Automotive Parts

The Michigan Drill Head Co., Detroit, Mich., has brought out a double-end drilling and assembling machine, Fig. 1, and an automatic shuttle fixture, Fig. 2, for use in the production of automotive parts.

The double-end drilling and assembling machine, Fig. 1, has a trunnion type automatic indexing table and is designed to provide high production in a limited work area. This machine drills two holes for the heat-control butterfly valve in a motor manifold; reams the holes; drills the stop-pin hole; feeds two bushings into position from a hopper; presses the bushings into place; stakes the bushings and reams them; and feeds the stop-pin from a hopper and presses it into place. These operations are performed automatically at a production rate of 120 manifolds per hour.

All units are hydraulically operated and lubrication is automatic. Ways are hardened and ground. Vickers controls are used on the hydraulic pump and the control panel, and J.I.C. construction is used throughout.

The two-station shuttle type reaming fixture, see Fig. 2, is designed for use on a Michigan Standard Hydro 5 machine. This equipment has a capacity for finish-reaming the holes in 1200 rocker arms per hour. It is claimed that no additional finishing of the rocker-arm shaft hole is necessary, as the machine gives a finish of between 20 and 30 micro-inches, r.m.s.

One station of the fixture is loaded while processing takes place at the other station. The fixture is built to J.I.C. standards. Coolant is supplied to each spindle, and all parts are lubricated automatically.

Accurately made interchangeable nesting plates for any size or shape rocker arm are available for this fixture. After the finish-reaming operation, the rocker arms are ejected automatically into a chute which conducts them to a tote pan.

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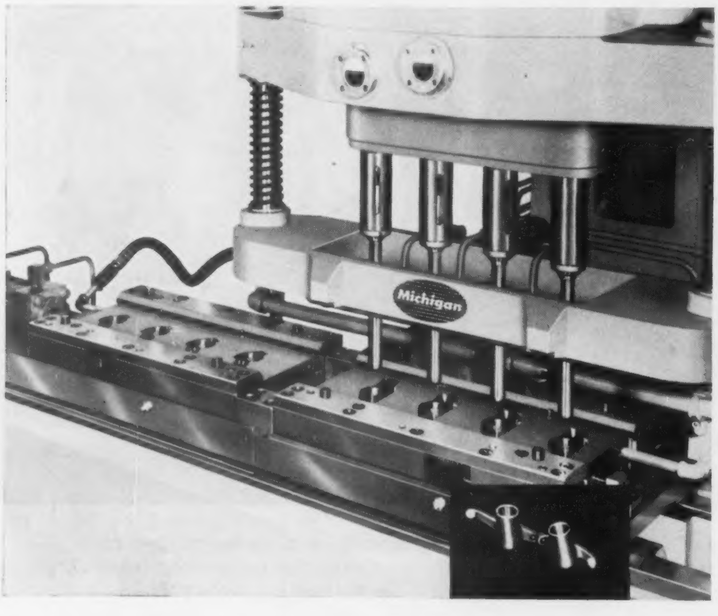


Fig. 2. Shuttle type fixture designed and equipped for reaming operations on rocker arms

Kodak Portable Contour Projector

A portable bench type contour projector, adaptable for either horizontal or vertical projection gaging, has been added to the line manufactured by the Eastman Kodak Co. It is being distributed by Optical Gaging Products, Inc., Rochester, N. Y. This Model 8 projector is designed for economical checking of small parts. The parts to be inspected can be staged in simple holding fixtures for horizontal projection or they can be placed on an easily mounted glass stage, with the machine turned on end, for vertical projection.

The Lumenized coating of the lenses, which increases light transmission, together with the special Kodak Ektalite field lens back of the screen yield a bright image and permit use of the projector anywhere in the plant. Six magnifications, ranging from 10X to 100X, are provided. All the lenses are quickly interchangeable and positively seated for the precise, rated magnification. The unique Kodak relay lens system gives ample, uniform working clearance at all magnifications. Changing from one power lens to another does not affect clearance.

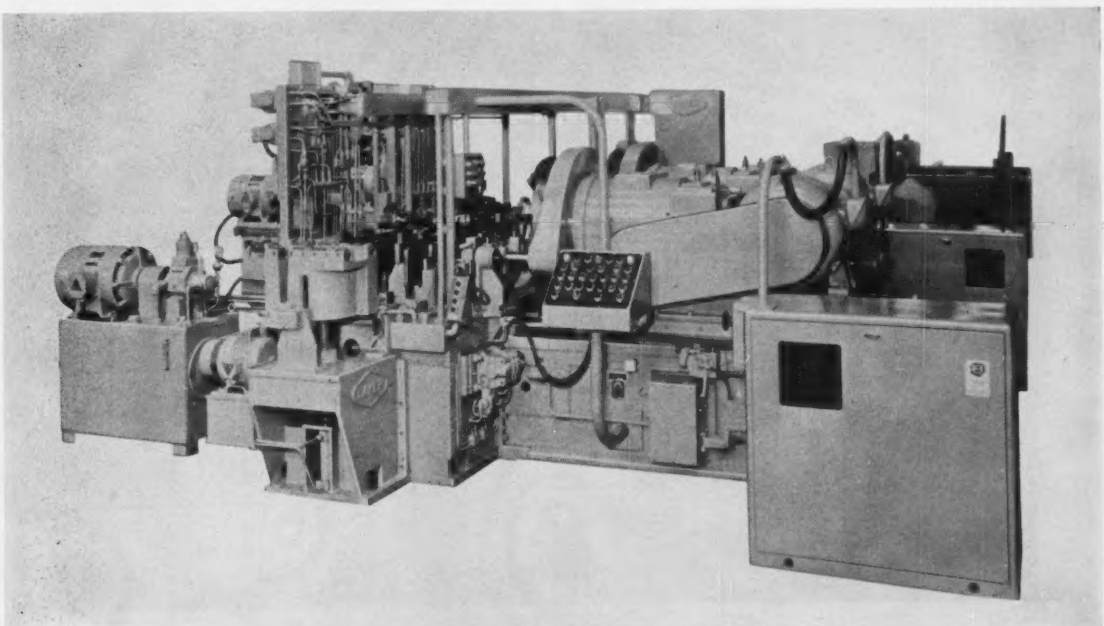
Portable contour projector brought out by Eastman Kodak Co.

Circle Item 111 on postcard, page 253

Baker Transfer Machine Designed to Handle Several Parts

A four-unit transfer machine has been built by Baker Brothers, Inc., Toledo, Ohio, for precision boring, chamfering and cross-feed facing operations on cylinder blocks and flywheel housing assemblies. The machine is arranged to handle either conventional or automatic transmission housings.

The units have cross-feed facing heads with heavy-duty enveloping type worm and worm-gear drives. Each unit is driven by a 10-H.P. direct-current motor with a variable-speed control. The control is designed to maintain a uniform surface cutting speed as



Four-unit transfer machine for handling parts built by Baker Brothers, Inc.

the diameter varies during a facing cut. Two spot-facing units are mounted opposite two round bar units.

The work-holding fixture has a hydraulically actuated transfer mechanism arranged to handle two parts at work stations while three parts are idle. The transfer mechanism picks up assemblies from the index table, which rotates them 90 degrees from the conveyor line, elevates and moves them 24 inches horizontally, and then lowers them into the clamping and working position.

The machine is arranged so that two units can be used to run conventional transmission blocks and housings while the other two units machine automatic transmission blocks and housings simultaneously. Through the use of skip indexing and call switches, it is even possible to process both conventional and automatic parts at random.

Circle Item 112 on postcard, page 253

Federal Gages for Precision Checking of Small Parts

A semi-automatic, electronic sorting gage for measuring small curved parts has been announced by Federal Products Corporation, Providence, R. I. This Model 144 B-53 gage, shown in Fig. 1, measures the chordal height of the curvature on thermostatic diaphragms and sorts them into six good or usable categories, plus over size and under size classifications. The speed of this hand-fed, timer-controlled gage is approximately 2500 pieces an hour, depending upon the dexterity of the operator.

The Multi-Dimensionair air gage, seen in Fig. 2, is employed for simultaneous inspection of four holes in a nozzle plate. The inspection consists of measuring the diameter of each hole and checking it for roundness. The piece is placed on the platen so that an air plug fits into each hole. First, the four Dimensionair dials are read to determine the hole diameters. If they all pass this test, a push rod, which is connected to all four plugs with a gear train to rotate the plugs, is pushed in and out to make the roundness check. The dials are then read from left to right as each hole is checked. This system eliminates the necessity of rotating the part itself.

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Chesterman Height Gage

A Chesterman height gage which has a triangular scale beam designed to provide exceptional strength and rigidity has been announced by the George Scherr Co. Inc., New York City. This gage is especially designed for use in laying out and checking large jigs, fixtures, and machine parts. The sliding head is traversed through its entire range by means of the full-length, large-diameter screw in the rear of the beam. The engaging nut is split and is disengaged for quick approximate setting of the head by simply pressing the two lugs on the sides and sliding the head along the beam.

Fig. 1. Federal semi-automatic electronic sorting gage for measuring small circular parts

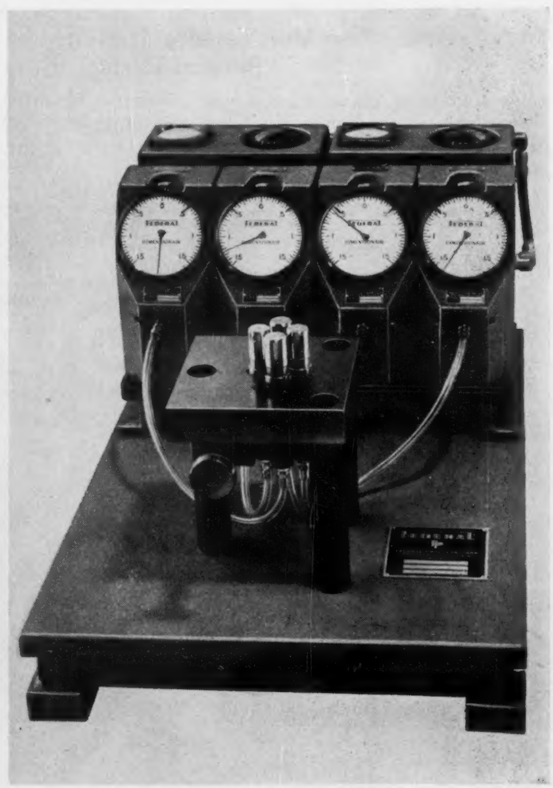
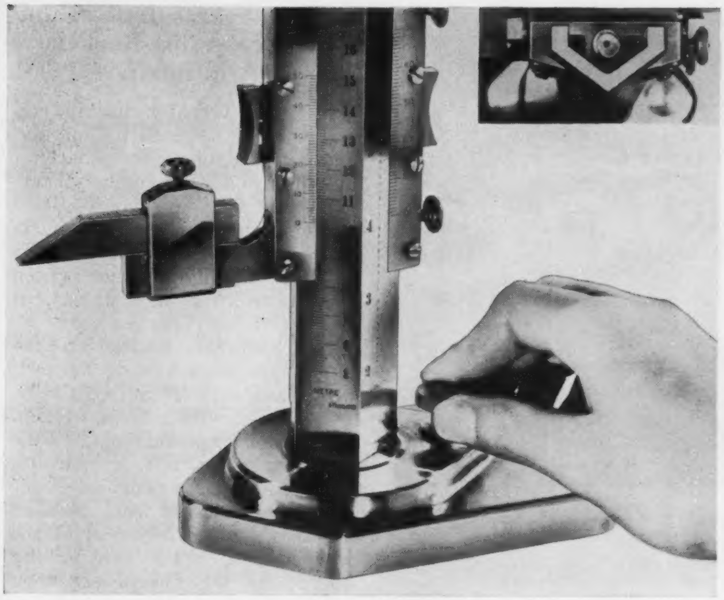


Fig. 2. Federal Multi-Dimensionair air gage for simultaneous inspection of four holes



Chesterman vernier height gage announced by the George Scherr Co.

One of the chief advantages of this gage is the location of the fine adjustment screw in the base. In making adjustments the downward pressure on the screw tends to hold the gage more firmly to the surface plate. The vernier is 2.450 inches long and is adjustable. The accuracy of the setting can be checked with a master gage-block.

A large, solid base, heavy enough to prevent tilting or toppling over, assures stability and accuracy. The gage is available in five sizes—from 12 to 48 inches.

Circle Item 114 on postcard, page 253

Cross Transfer-matic for Machining Gear Housings

A "Transfer-matic" designed to machine rear-axle differential gear housings at the rate of 155 per hour has been built by The Cross Company, Detroit, Mich. This machine has nine stations, one for loading, four for boring, one for tapping, two for indexing and one for visual inspection. The operations include rough- and semi-finishing of the pinion bores, rough-boring, semi-finish boring and tapping the cross-bores.

Because of the shape of the differential gear housings, pallet type work-holding fixtures are used in which the parts are clamped by means of hydraulic power wrenches. The fixtures are moved from station to station and returned to the loading station automatically. Both the standard and special parts of the new Transfer-matic are completely interchangeable. This facilitates re-tooling to suit changes in the design of the product. Electric and hydraulic construction conform to J.I.C. standards. Other features include hardened and ground ways, tandem drive for locating the pins, hydraulic feed and rapid traverse, and automatic lubrication.

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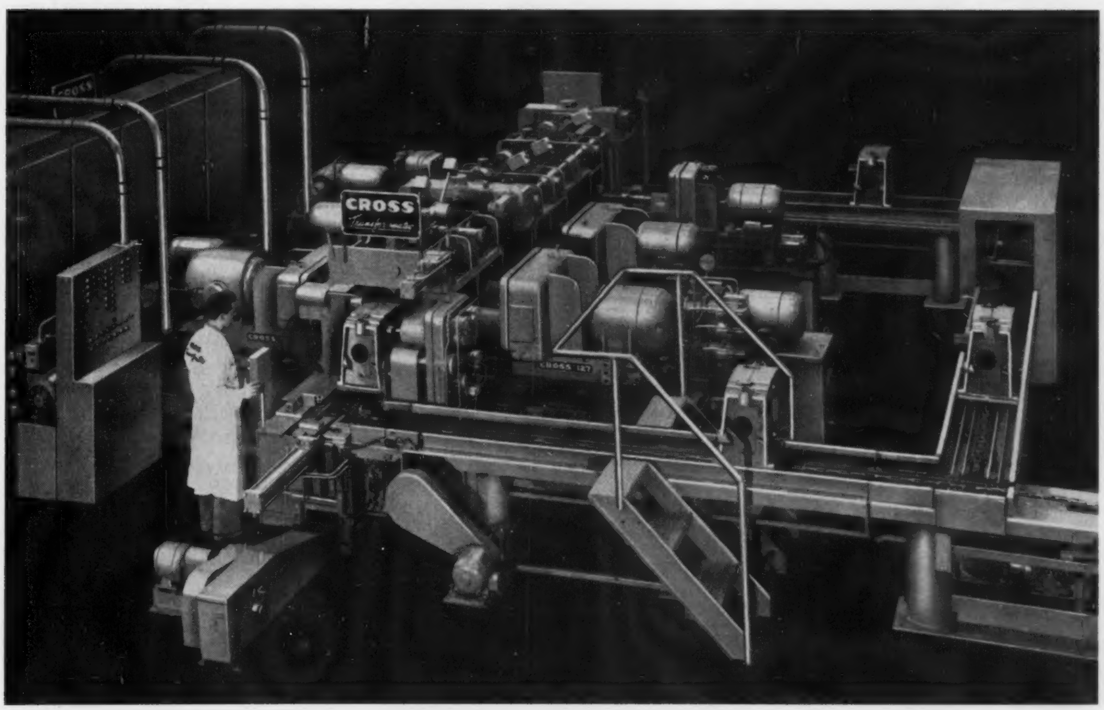
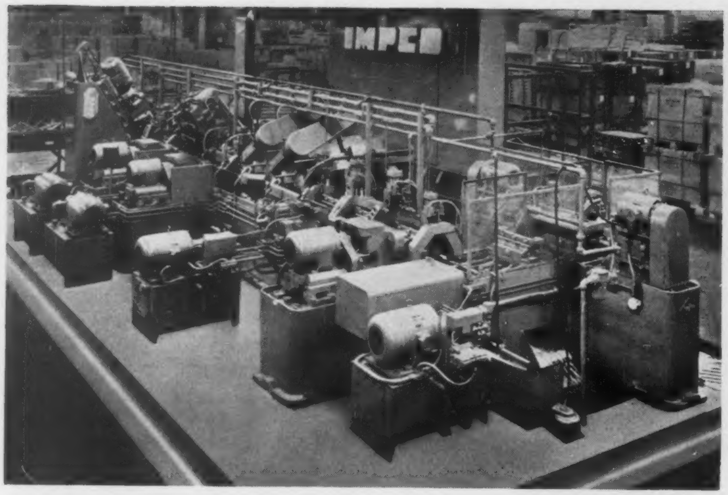
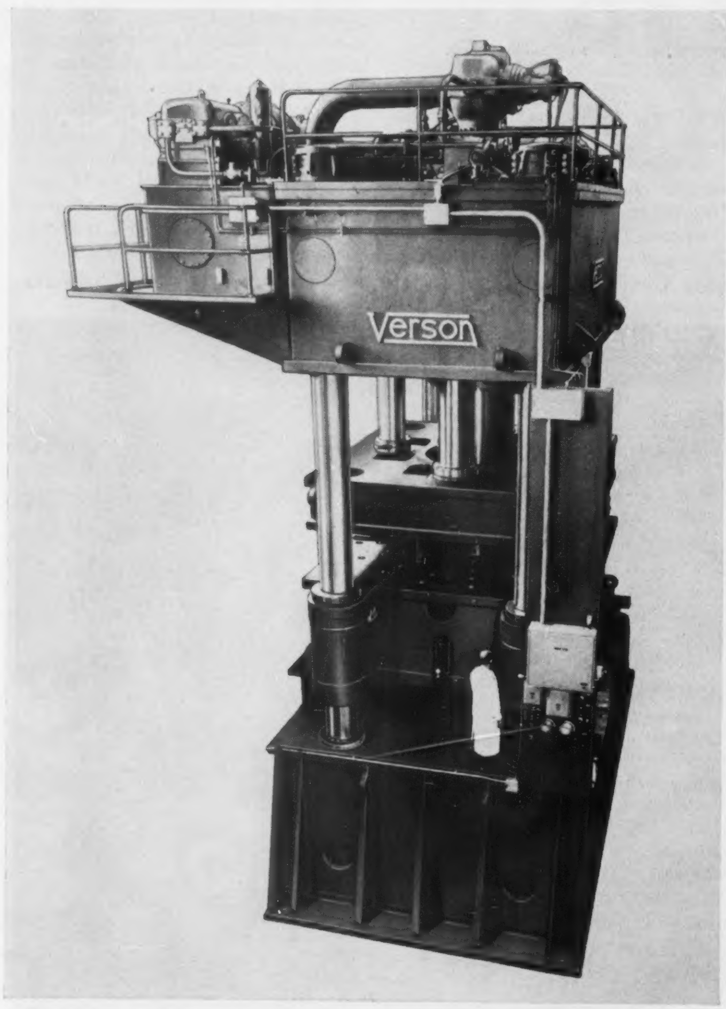


Transfer-matic for machining rear-axle differential gear housings built by The Cross Company.



Special transfer machine for processing rocker-arm shafts built by Industrial Metal Products Corporation



Gigantic hydraulic press designed and manufactured by Verson Allsteel Press Co., for stamping heads for pressure vessels.

Automatic Transfer Machine for Processing Rocker-Arm Shafts

A special transfer machine designed to perform all the milling, drilling, reaming, and checking operations on a V-8 engine rocker-arm shaft is being manufactured by the Industrial Metal Products Corporation, Lansing, Mich. The complete machine cycle is ten seconds which gives a gross production of 360 parts per hour.

The parts are loaded into the pallet type work-holding fixtures, positioned endwise automatically, and clamped with a power wrench. The transfer system, including the return transfer unit, is hydraulically operated. Holes drilled at one station are automatically checked at the next and deburred at the last station, after the milling operations. The parts are then automatically unclamped and unloaded on the return side of the machine. Automatic lubrication, automatic chip conveyor, and a pallet wash are also features of the machine.

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Verson Hydraulic Press

A huge hydraulic press standing four stories high and weighing over 1,000,000 pounds has been built for the Colorado Fuel & Iron Co., by the Verson Allsteel Press Co., Chicago, Ill. This gigantic press will exert a pressure of 6,000,000 pounds with power developed by a 300-H.P. electric motor. The press will be used to form hemispherical and elliptical heads for pressure vessels ranging in size from 40 inches to 10 feet in diameter and up to 3 feet in depth. These heads will be formed from heavy steel plate in one stroke of the press.

Circle Item 117 on postcard, page 253

Auto-Vac Vacuum- and Drape-Forming Machines

The Auto-Vac Co., Fairfield, Conn., has just announced a new line of vacuum and drape-forming machines. The machines in this line incorporate several innovations in both design and construction, including "3-D double-action drape." This is achieved by making the clamping frame so that it can be adjusted to any height up to 24 inches above the molding

Vacuum- and drape-forming machine incorporating new design features announced by the Auto-Vac Co.

table. The fully adjustable draping distance up to 12 inches is retained. This improvement together with the machine's exclusive type of four-way, fully adjustable clamping frame which can be adjusted from 6 by 10 inches to maximum machine sizes of 24 by 36, 30 by 50, or 48 by 72 inches results in "3-D double-action drape."

The synchronized, automatic lever-and-toggle action of the clamping frame eliminates the need for any special holding dies for thermoplastic sheets. Perfect clamping adjustment is insured through the use of free-swinging, twin air cylinders. As the frame is lowered on thermoplastic sheet, the rear edge rises, then lowers in unison with the front edge, resulting in an automatic adjustment to suit the gage of the sheet.

Heating is accomplished by General Electric special Calrod units. Super-sensitive thermocouples permit maintenance of the desired temperature within plus or minus 5 degrees. Current consumption is said to be less than 8 watts per square inch of heater space. The instrument control panel on front of the machine has automatic and manual controls.

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Giant Size H-P-M Hydraulic Briquetting Press

A huge briquetting press built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has recently been installed by the Sharon Steel Corporation, Sharon, Pa., at its Niles Rolling Mill Division plant, Niles, Ohio. This is believed to be one of the largest combination vertical-horizontal hydraulic briquetting presses in the country. It is now producing briquettes from titanium sponge for the Mallory-Sharon Titanium Corporation.

The press has two actions—the vertical ram has a maximum pressure of 3000 tons and the horizontal ram 1500 tons. It forms briquettes from 3 to 6 inches thick by 6 inches wide by 20 inches in length. The press weighs approximately 500,000 pounds, has an over-all length of 25 feet 10 inches, and a height of 20 feet above floor.

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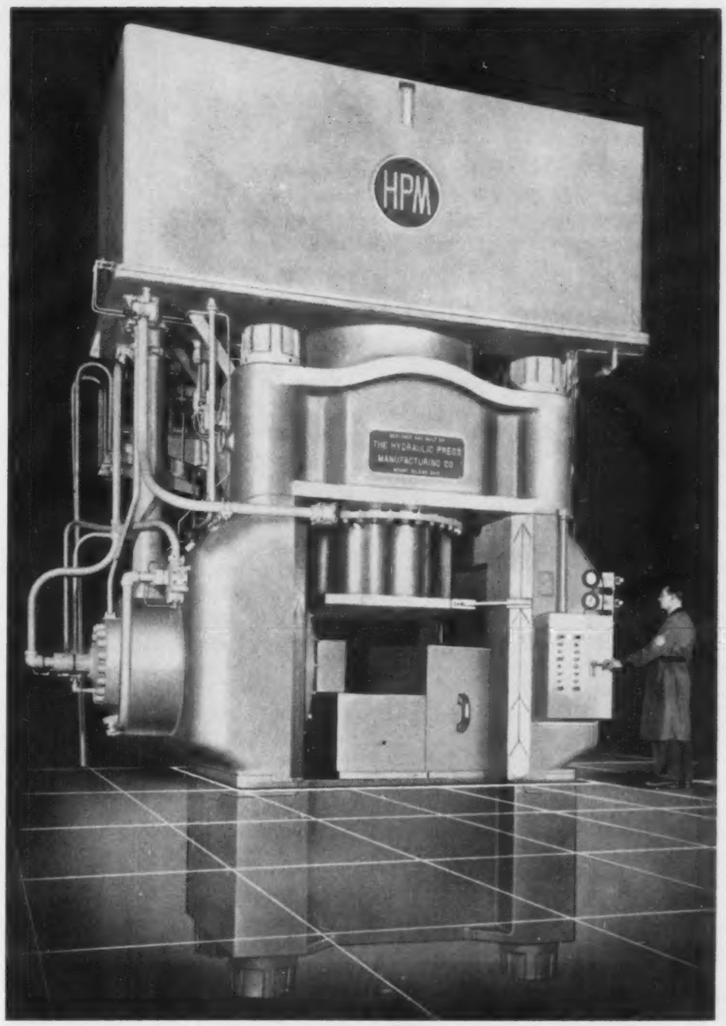

Briquetting press of giant size built by Hydraulic Press Mfg. Co.

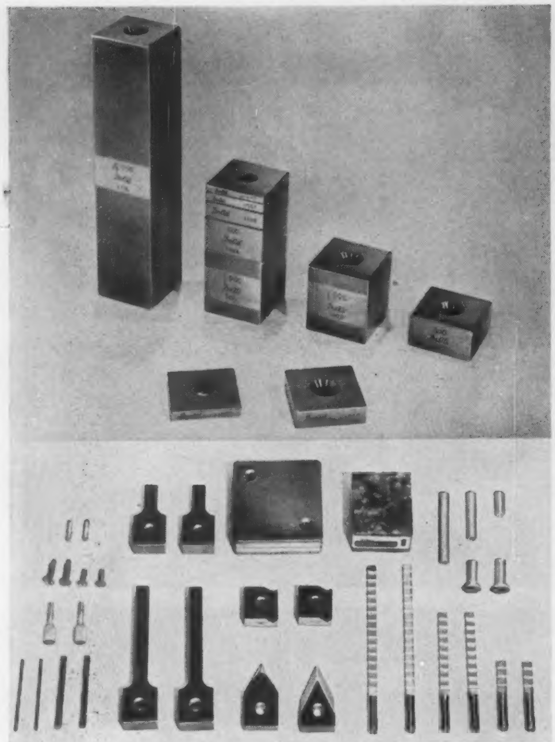

Fig. 1. (Upper View) Square gage-blocks added to line of rectangular blocks and gaging equipment made by the DoAll Co. (Lower View) Accessories for use with square gage-blocks shown above

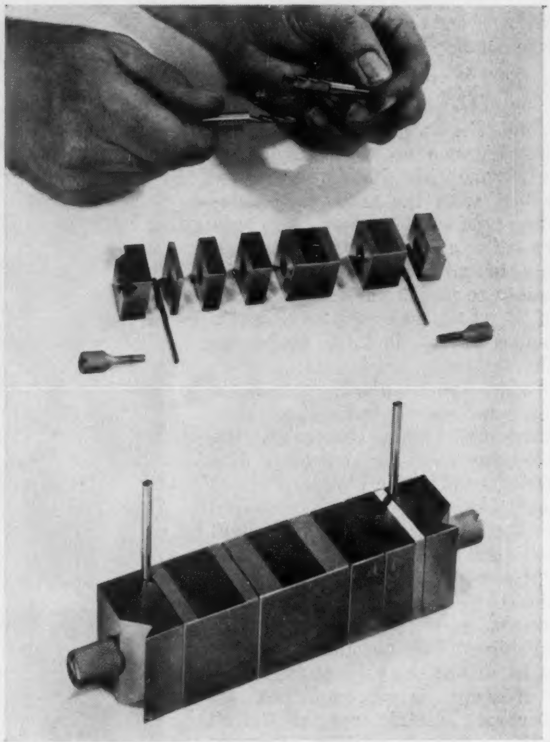

Fig. 2. (Upper View) Assembling an inside caliper gage, using DoAll square gage-blocks and accessories shown in Fig. 1. (Lower View) Enlarged view of the assembled inside caliper gage

DoAll Square Gage-Blocks and Accessories for Assembling Working Gages

The DoAll Co., Des Plaines, Ill., has added square gage-blocks, of the design shown in the upper view, Fig. 1, to its line of rectangular gage-blocks, Micro-Step gaging system and other gaging equipment. A new system using the accessories shown in the lower view, Fig. 1, has been developed to extend the use of the square gage-blocks in everyday shop and tool-room inspection work. The exceptionally fine surface finish of the square blocks is said to facilitate wringing them together, and to minimize wear.

The new system and its accessories can be used with all standard square blocks. It is designed to permit direct application of gage-blocks to regular gaging and lay-out operations, with greatly reduced chances for making costly errors in the manufacture of tools and dies.

Tie-rods are provided for assembling stacks of blocks. These rods interlock at 1/4-inch increments by means of ratchet teeth milled on their sides as shown in the upper view, Fig. 2. A rod of the desired dimension is obtained simply by laying one rod against the other so that the ratchet teeth match at the desired point. A large base block 2 1/2 inches square is provided for secure mounting of vertical gages. This block has two mounting holes in opposite corners to permit anchoring two assemblies—for example, "Go" and "Not-Go" height gages. The surface area of the base block is large enough to accommodate as many as four gage assemblies which can be wrung to its lapped surface.

The "gaging members" used in the block assemblies, make it possible to check a great variety of work over a wide range of sizes. Flat caliper jaws with 1- and 3-inch extensions permit checking outside diameters up to 5 7/8 inches. For checking inside diameters, round caliper pins, available in diameters of 0.100 and 0.200 inch, are held in the assembly with specially designed V-blocks as shown in lower view, Fig. 2. This design permits turning the pins to expose new gaging surfaces as they wear.

An outstanding development of the square-block gaging system is the accessory set for assembling "indicating square-block gages." Special drilled and tapped gage-blocks accommodate brackets for holding dial indicators in several positions, depending on the nature of the gaging task. The dial indicator, not shown, can be end-mounted on the stack of gage-blocks for use as an indicating pin gage, front-mounted for use as a comparator or side-mounted to check heights over shoulders.

Gage-blocks and accessories are packed in warp-proof, plastic cases. The basic accessory set, as distinct from the indicator set, includes tie-rods, sleeves and thumb-screws for assembling square blocks; the base block; 1- and 3-inch flat caliper bars, 0.100- and 0.200-inch diameter caliper pins and V-blocks for holding these pins, scriber and center point; and a granite deburring stone.

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Michigan Sine-Line Gear-Checking Machine

A Sine-Line involute gear checking machine designated Model 1124-P is announced by the Michigan Tool Co., Detroit, Mich. This equipment will check involute contours and tooth spacing of gears ranging from 0 to 24 inches in diameter on shafts up to 60 inches long. It utilizes the sine-bar principle to develop the tracing motion for indicating a true involute and has rapid reading and easy charting characteristics. Only one master disc and the sine-bar are needed to obtain the proper ratio between the master disc and the base diameter of the gear being checked.

Changing the set-up from one gear to another requires only a few seconds. The sine-bar is merely set to the correct corresponding angular position as given by standard formulas or tables, and the indicator contact finger is set on the new base diameter. A removable bracket attached to the indicator head holds fingers for checking tooth spacing. Both spur and helical gears can be checked while mounted on solid or tubular shafts. Checking of helical gears is accomplished in either the normal or transverse plane. When using the tooth-spacing attachment to check teeth in sequence, the indicator is retracted toward the operator and the gear is indexed to the next tooth.

A simple accessory permits checking internal gears in the same manner as external gears. The involute profile and tooth spacing on long splined shafts are readily checked. A pneumatic tailstock that facilitates handling large gear and shaft assemblies is available as an accessory. The checking machine is 113 1/2 inches high and requires a floor space 62 by 47 inches.

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Noblewest Marking Press

A precision dial feed press for high-speed production marking has been announced by Noble & Westbrook Mfg. Co., East Hartford, Conn. The new press, known as the Model 400, is air operated and electronically controlled. It will produce serial numbers on work-pieces at the rate of 2500 parts per hour. The "Cyclomatic" control of this machine is unique in that loading time and marking dwell can be varied independently.

The circuit includes supplementary controls for semi-automatic operation from a foot-switch and independent operation of press head and dial feed for set-up purposes. The machine can also be used for crimping, staking, forming, and riveting, and larger models are available for heavy-duty work. Riveting or drilling heads can be added to or substituted for the press head.

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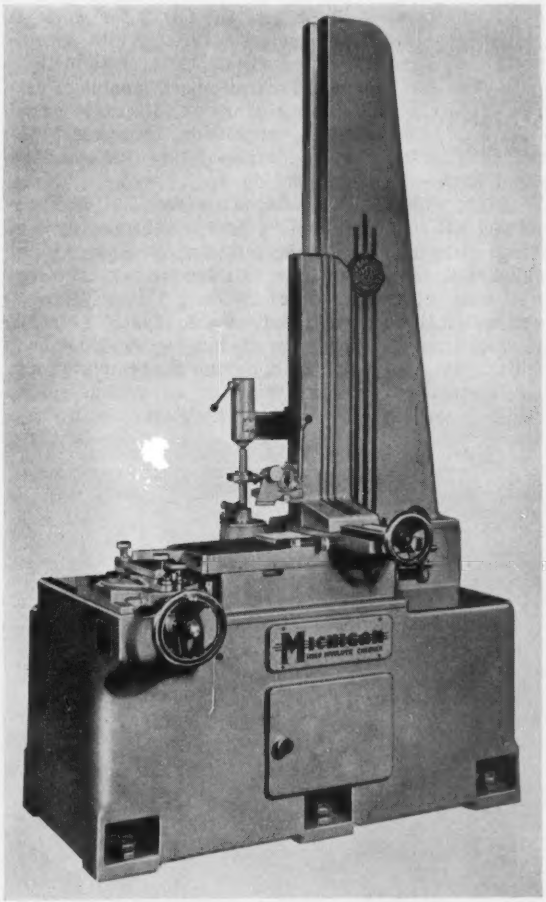
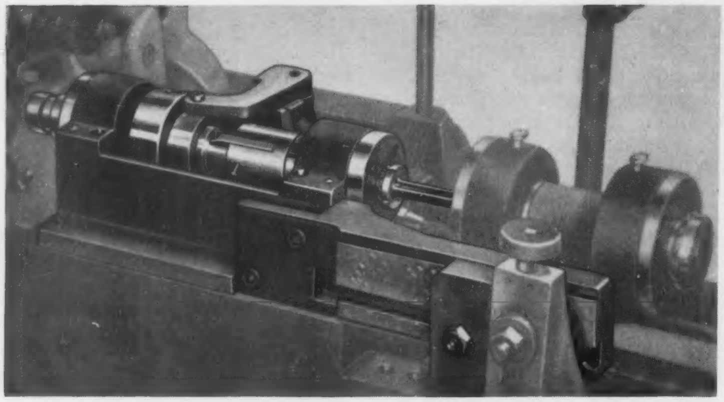


Sine-Line gear-checking machine announced by the Michigan Tool Co.

Multi-purpose dial feed marking press announced by the Noble & Westbrook Mfg. Co.



Howard Swiss type automatic lathe equipped with sliding head designed for mass production

Howard Sliding-Head Automatic Lathe

A sliding-head automatic lathe of the Swiss type, built domestically to American standards for mass production of parts up to 3/16 inch in diameter by 2 3/4 inches long, has been announced by the Howard Automatic Division, Detroit Cam & Tool Co., Ferndale, Detroit, Mich. The same machine base, power units and tooling are used for this Howard D-187 model as employed on the 1/2-inch Howard D-500 machine previously introduced on the market by this company.

Spindle speeds up to 15,000 R.P.M. under pressure lubrication can be used on this machine to obtain a very fine finish. The entirely new, highly sensitive sliding head with completely independent pulley carrier bracket designed to eliminate deflection of the spindle and slide makes it possible to hold work to extremely close tolerances.

Attachments for drilling, chamfering, counterboring, tapping, threading, slotting and tapering are interchangeable on the D-187 and D-500 machines.

Circle Item 123 on postcard, page 253

Roll Type Machine for Planishing Welds

Airline Welding and Engineering, Hawthorne, Calif., have brought out a Model R-4000 planishing roll having a 60-inch throat. The adjustable low to high pressures available with this planishing machine permit it to be used to roll welds on steel (including stainless steel), titanium, aluminum and other metals. It smooths fusion welds, increases physical properties and refines the grain of the weld and adjacent metal.

Provision is made for controlling cold-working of weld and heat-affected zones. The machine lessens the need for grinding welds and assists spinning, bulge-forming and sizing operations. It rolls welds on flat sheets, cylinders and cones, and handles work from 1 3/4 inches to 10 feet in diameter and up to 10 feet in length. Provision is made for controlling the pressure on the rolls.

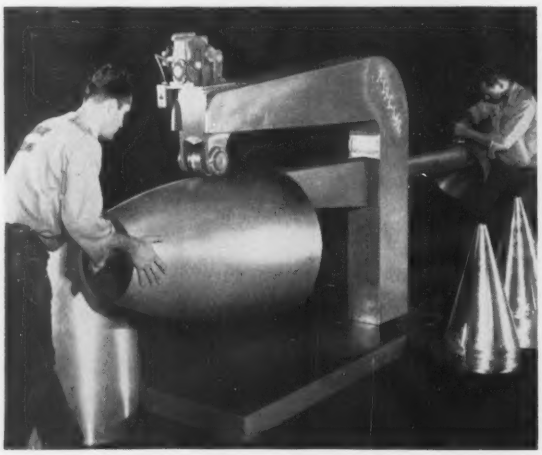
Circle Item 124 on postcard, page 253

Contour Milling Machine

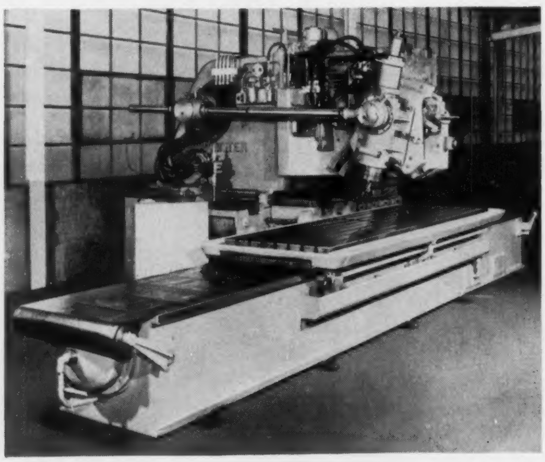
The Bridgwater Machine Tool Co., Akron, Ohio, is introducing two new types of their contour milling machine. The R310 machine has a rectangular-shaped work-table available in lengths up to 20 feet, and the CD72 machine is made with a circular work-table 72 inches in diameter.

The R310 machine is employed mainly for work of rectangular shape, and the CD72 for work of a circular nature. While specifically designed to meet industry's need for equipment capable of machining complex aircraft structural components, these machines are adaptable for use in standard duplicating work.

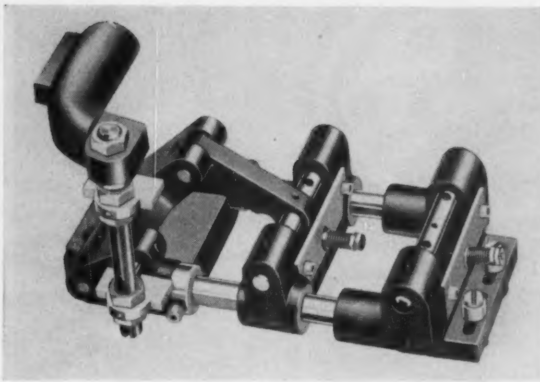
The tracing motions are obtained by an entirely new system of hydraulic control. The guiding brain of this system is a tape cam made of du Pont "Mylar," an exceptionally stable plastic material. Fabricated into an endless belt, this cam, having the template form of the piece to be milled, guides the stylus which actuates the hy-



Airline roll type weld planishing machine



Bridgwater contour milling machine



Automatic "Surefeed" made by the Producto Machine Co., for feeding stock to punch press

Special electronic gage for small parts using gage-head cartridge made by Brown & Sharpe Mfg. Co.

draulic tracing device valves. This method eliminates the need for a separate template table, and makes it possible for an operator to control all cutting motions from his station near the work-head and spindle. Cutting the template form into the cam belts is done by the machine itself.

Circle Item 125 on postcard, page 253

Automatic "Surefeed" for Press

An automatic feed for punch presses called the "Surefeed," designed to handle stock in widths up to 3 inches has been introduced by the Producto Machine Co., Bridgeport, Conn. All wearing parts of this hitch type feed are made of hardened and ground tool steel to insure long service. The adjustable gripper plates can be reversed to further extend the useful life of the feed.

This feed can be mounted on the die set so that the two units can be handled as one. No press or feed alterations are required when mounting the "Surefeed" in any ordinary press. Only two drive plates and simple linkage, controlled by the movement of the press, are used to advance the stock. The direct feeding action of the unit is said to make possible a relatively high degree of accuracy. However, pilots can be used for exact register of stock.

The feed handles stock in thicknesses ranging from 0.005 to 0.055 inch. The feed length for presses having a 1-inch stroke is 0.000 to 7/8 inch and for presses having a stroke of 1 1/2 inches or more the feed length is 0.000 to 3 inches.

Circle Item 126 on postcard, page 253

Matrix optical twist drill comparator announced by the Engis Equipment Co.

Gage-Head Cartridge for Special Electronic Gaging Devices

A relatively inexpensive electronic gaging device for small parts can be assembled by employing a regular gage-head cartridge made by the Brown & Sharpe Mfg. Co., Providence, R. I. This application offers possibilities in plants where small parts are accurately gaged in large quantities.

A typical application of the gage-head cartridge to the gaging of small parts is shown in the accompanying illustration. In this case the cartridge has been set at an angle to give a clearer view of the gage. The cartridge can be positioned quickly for taking measurements over a 2-inch range. The anvil, which is threaded into the base, has a range of 3/4 inch.

Circle Item 127 on postcard, page 253

Comparator for Checking Angle and Location of Drill Points

A comparator designed to facilitate accurate checking of angle and centrality of small drill points has been announced by the Engis Equipment Co., Chicago, Ill. This new matrix optical-twist drill-point comparator consists essentially of a special small projector of 5X magnification with an interchangeable screen to suit individual or standard needs, which can be placed at the drill grinding machine to insure accurate grinding of drills from 1/16 to 1/4 inch in diameter. Equipment includes a quick-acting locator and focusing knob.

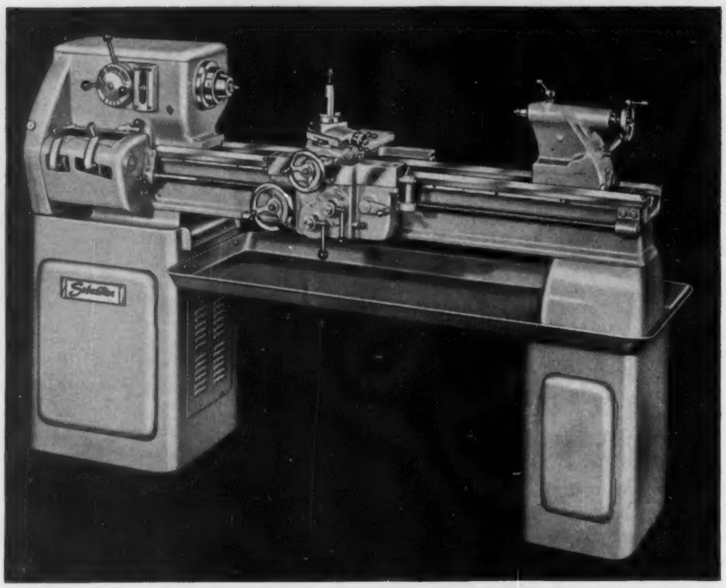
Circle Item 128 on postcard, page 253

Sebastian Geared-Head Lathe

A 15-inch Sebastian geared-head lathe, designed to combine power with tool-room accuracy, is being built by the Sheldon Machine Co., Inc., Chicago, Ill. Features of this lathe include: wide, heavy, bed; anti-friction bearing headstock with "zero precision" tapered roller bearings which support the spindle; cam-action tailstock clamp; and spindle speed dial.

The thick-walled spindle has multiple splines which provide extra strength and rigidity. The long tapered key-drive nose is standard equipment. All gears in the headstock run in oil, are extra wide, and designed for quiet operation. The large gear-box provides for sixty different thread pitches and feeds. The reverse lever on the gear-box permits the operator to change the direction of the lead-screw rotation while the lathe is running.

A cam-action clamp permits rapid release and instant locking of the tailstock. The massive carriage has an extremely large bearing surface. A built-in, one-shot oiling system provides lubrication for all bearing surfaces. Two friction disc type clutches in the large apron provide power longitudinal and power cross feeds. These clutches can be engaged individually or simultaneously. A cabinet in the pedestal leg provides storage space for tools and accessories.

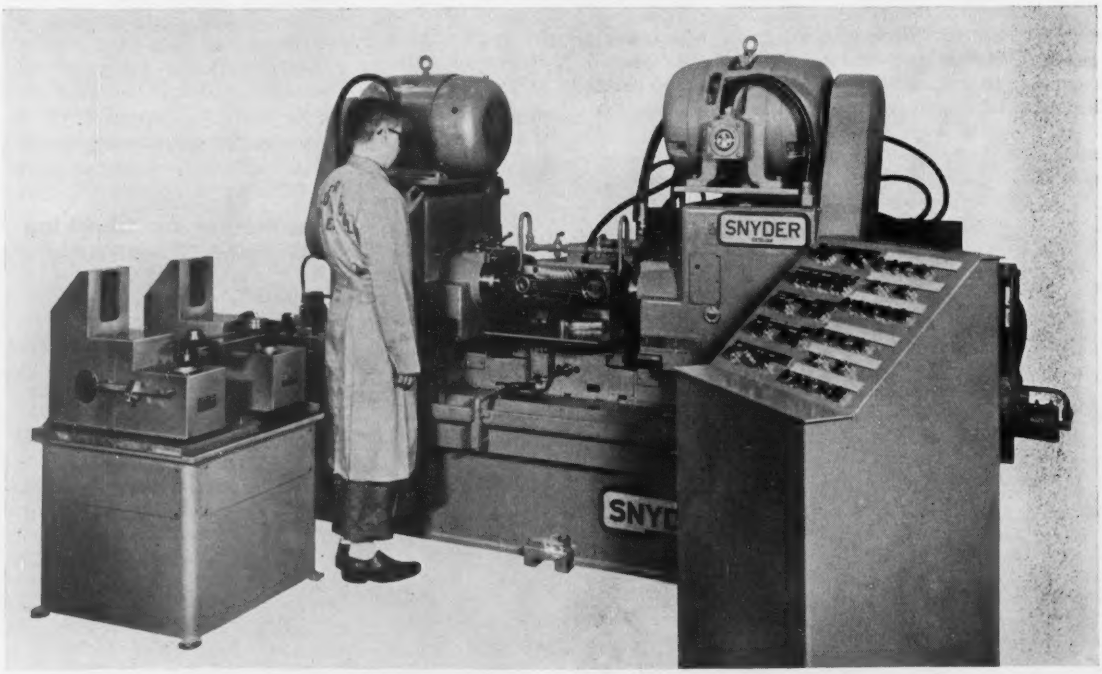


Sebastian lathe built by the Sheldon Machine Co., Inc.

Circle Item 129 on postcard, page 253

Precision Balancing Machine for Heavy Parts

A precision balancing machine designed to handle a variety of heavy-duty parts, including Diesel engine connecting-rods with center distances ranging from 7 3/8 to 12 1/2 inches, is announced by



Precision balancing machine for heavy-duty parts and Diesel engine connecting-rods placed on the market by the Snyder Tool & Engineering Co.

the Snyder Tool & Engineering Co., Detroit, Mich. The machine is made up of three individual units: a milling machine having two opposed double-spindle heads, a console containing all operating controls, and a precision weighing unit.

To balance a connecting-rod forging it is first placed on the weighing unit which automatically adjusts the milling machine to remove the correct amount of stock from the piston and crankshaft ends of the forging to obtain an accurately balanced connecting-rod. The rod is then manually removed from the weighing unit and placed in a fixture on the milling machine. Pushing a cycle button causes the fixture to clamp the rod in place while the milling operation is performed.

The entire production unit occupies a floor space about 136 7/8 inches wide by 121 1/4 inches deep, and is about 7 feet high. A 15-H.P. motor is provided on the machine illustrated for the cutters that mill the crankshaft end of the rod, and a 7 1/2-H.P. motor drives the cutters that mill the piston end of the rod. All head and fixture movements are hydraulically controlled.

Circle Item 130 on postcard, page 253

Cincinnati General-Purpose Centerless Grinding Machine

A small size, general-purpose centerless grinding machine has just been announced by Cincinnati Grinders, Inc., Cincinnati, Ohio. This No. O machine is designed for grinding a variety of metallic and non-metallic parts ranging up to 1/2 inch in diameter. Low power consumption, small floor space requirements, and low capital investment are advantages claimed for this machine which make it an efficient, low-cost producer of small shafts, drills, pins, instrument parts, and similar products.

The grinding wheel spindle is mounted in a Cincinnati "Filmatic" spindle bearing, which is self-adjusting for heavy roughing cuts or light finishing cuts and requires no maintenance for the service life of the machine. Spindle lubrication is automatic and positive. An automatic cut-out stops the spindle-driving motor if the lubricant pressure fails.

The spindle bearings are rigidly mounted in the bed casting, without joints or sliding elements. The regulating wheel unit is carried on the base in two dovetail slides to permit adjustment of the work-rest in relation to the regulating wheel, and adjustment of both work-rest and regulating wheel in relation to the grinding wheel.

A swivel plate between the lower slide and the base permits correction of slight errors in straightness without having to retrue the wheels.

The regulating-wheel speeds are infinitely variable from 22 to 300 R.P.M. to permit selection of the exact speed required for efficient cutting on any particular job. The regulating-wheel speed is indicated on a tachometer. The tachometer dial, used in conjunction with the single handwheel control of the regulating-wheel speeds, makes changing of speeds as easy as setting a watch.

The standard grinding wheel truing attachment is hydraulically actuated and trues the wheel to a straight cylindrical shape and to slight tapers if desired. An hydraulically operated profile truing attachment is available at extra cost. Profile type truing attachments are equipped to take either round or flat profile cams. All truing attachments are of the diamond type.

Work-rests are available for infeed or through-feed methods of grinding. A "Roto-Feed" automatic infeed attachment is also available at extra cost for the automatic grinding of parts by the infeed method. Grinding wheels up to 16 inches in diameter with a mounting hole 10 inches in diameter and a maximum width of 4 inches are used in separate wheel mounts with four adjustable balance weights. Regulating wheels have a maximum diameter of 9 inches, a center hole 4 inches in diameter and a maximum width of 4 inches. They are mounted directly on the end of the regulating-wheel spindle.

A 40-gallon cutting-fluid tank and motor-driven pump are located at the rear of the machine. All electrical motors are completely enclosed within the machine to protect them from dust, grit and cutting fluid, yet they are easily accessible for servicing.

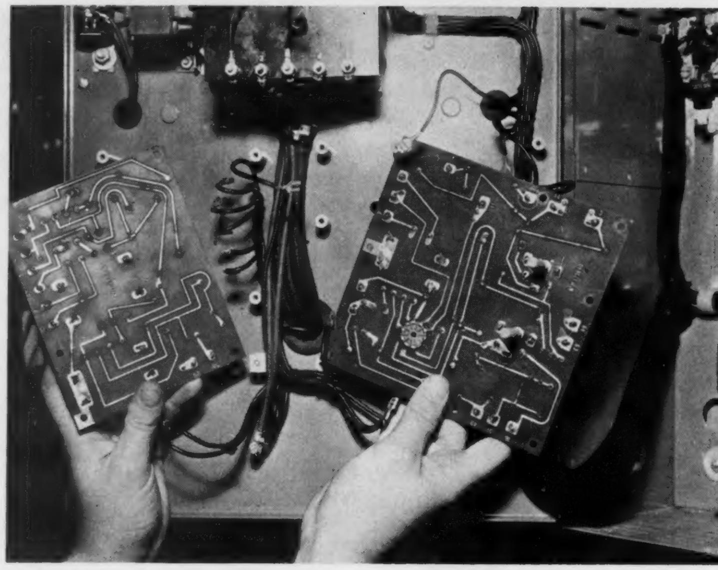
Circle Item 131 on postcard, page 253

General-purpose centerless grinding machine recently announced by Cincinnati Grinders, Inc.

G-E Thy-mo-trol Control with Printed Circuits

Printed circuits and a simplified control system are features of a line of full-wave Thy-mo-trol electronic adjustable-speed drives brought out by the General Electric Co., Schenectady, N. Y. The print-board panels can be visually inspected for circuit faults, since they are actually current-carrying diagrams, and can be removed and replaced in a few seconds.

The control is available in two ratings of 3/4 to 1 H.P. and 1 1/2 to 3 H.P. Basically an automatic electronic control for direct-current motor drives, the new control is designed to give stepless speed control from an alternating-current power source over an 8 to 1 ratio speed range, with higher speed ranges possible for special applications. It consists of electronic sensing elements and an electronic power rectifier. The control maintains very close speed regulation regardless of changes in load or line voltage, and it limits the starting torque to protect both drive and machine against overloads at all times. These drives, with conventional circuits, are available in full- or half-wave models in ratings up to 1/2 H.P. Full-wave precision models are also available in ratings from 3/4 to 30 H.P.



Printed circuits of Thy-mo-trol control introduced by the General Electric Co.

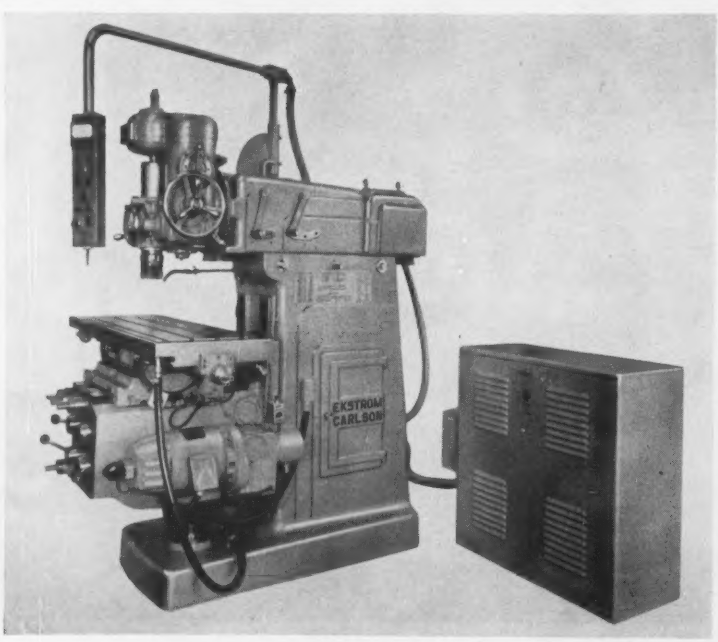
Circle Item 132 on postcard, page 253

Ekstrom, Carlson Vertimil

A 5VA Vertimil incorporating several new features has just been announced by Ekstrom, Carlson & Co., Rockford, Ill. This machine has the tilting spindle head, and tilting work-table design of the company's earlier 5V Vertimil. The knee of the 5VA machine is of entirely new design and is operated electronically by a 3-H.P. direct-current variable-speed drive with a current rectifier panel. This equipment provides a table feed range (both crosswise and longitudinally) of from 0.250 inch to 100 inches per minute in two simple stages, the speeds being continuously variable in each stage.

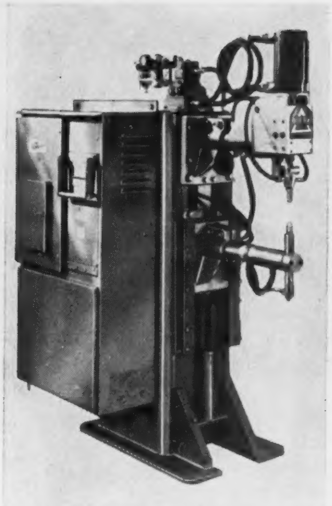
The vertical table feed range is from 0.070 inch to 38 inches per minute, with the speed also continuously variable in two simple stages. Rapid traverse up to 100 inches per minute is obtained by pressing the rapid traverse button located on the pendant type control station. Releasing the push-button returns the feed to its pre-set feed.

The 5VA Vertimil is available with either 5-, 10-, or 25-H.P. spindle drive motors. Spindle speeds ranging from 36 to 1240 R.P.M. can be obtained with the 5-H.P. motor, while both the 10- and the 25-H.P. spindle drive motors provide spindle speeds from 72 to 2480 R.P.M. The maximum vertical throat clearance measures 19 1/2 inches while the minimum and maximum distances from the spindle to the base column measure 8 and 30 inches, respectively. The work-table is 20 by 56 inches and has four 11/16-inch wide T-slots.



Vertimil of improved design announced by Ekstrom, Carlson & Co.

Circle Item 133 on postcard, page 253



Delta heavy-duty spot-welder

Welder for Medium-Gage Sheet Metals

The Delta Welder Corporation, Detroit, Mich., has brought out a high-production, heavy-duty spot-welder designed for resistance welding of medium-gage sheet metals. The fabricated steel frame of this welder is of formed boiler plate. The upper head has a hardened and ground, lubricated slide mounted in adjustable vee gibs to insure accurate alignment, and a smooth travel movement.

The lower arm of this machine is completely adjustable in a vertical direction from 13 inches between the arms in a closed position to 23 inches in an open position. The lower arm is also adjustable in a horizontal plane from the standard throat depth of 18 inches to within 9 inches of the machine face.

Circle Item 134 on postcard, page 253

Carboloy Solid Cemented-Carbide Planing Knives

Solid cemented-carbide planer knives are now produced in lengths up to 72 inches by a new process developed by the Carboloy Department of General Electric Co., Detroit, Mich. The carbide knives have been used on Buss Micro-Surfacer machines for planing abrasive materials such as rubber and plastic tile, all types of hardboard materials, and automotive brake linings, providing continuous precision cuts.

Circle Item 135 on postcard, page 253

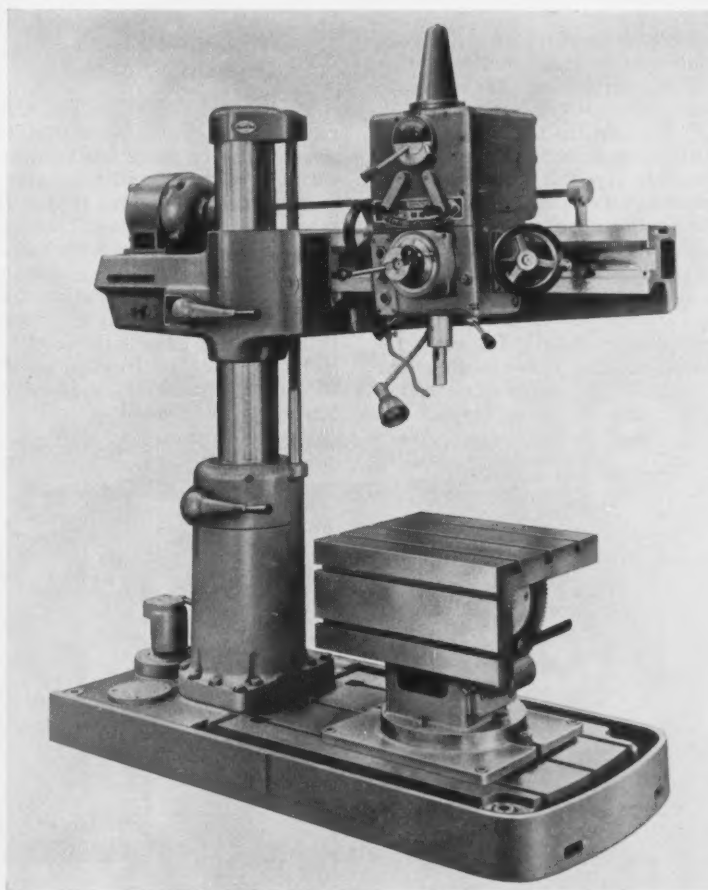
Cincinnati "Hardclad" Radial Drill with Flame-Hardened Column

The "Hardclad" radial drill recently announced by the Cincinnati Lathe & Tool Co., Cincinnati, Ohio, is claimed to be the first machine of this type to have a precision-ground, flame-hardened column. The process of flame hardening was developed to provide a means for retaining the original accuracy of the column and to prevent this member from becoming scored. The column has a thick centrifugally cast wall and is accurately turned, surface flame-hardened, and then finish-ground to close tolerances and a mirror-like finish.

Other features include spindle-speed and feed-shift dials of the two-lever, direct-reading, color-match type. All controls, including the start-stop push-buttons, are grouped within easy reach of the operator. The No. 3 Morse taper spindle is mounted in four anti-friction bearings and has nine spindle speeds and six power feeds. All speed and feed shafts are mounted in anti-friction bearings. The entire internal mechanism is forced-spray lubricated. The 1 1/2-H.P. main-drive motor is mounted on the arm at the left of the column to provide easy accessibility and serve as a counterbalance. Power is transmitted through a silent chain and drive-shaft.

Safeguards for the operator include the electrical panel built into the back of the arm. A safety switch prevents exposing a live panel when the access door is opened. A transformer that reduces line current to 110 volts at the controls is a major safety feature. The raise-lower push-buttons are covered by a guard to prevent vertical movement of the arm until the barrel clamp is released.

Stability is provided by the new waffle-ribbed base, of ample floor area and weight. The column sup-

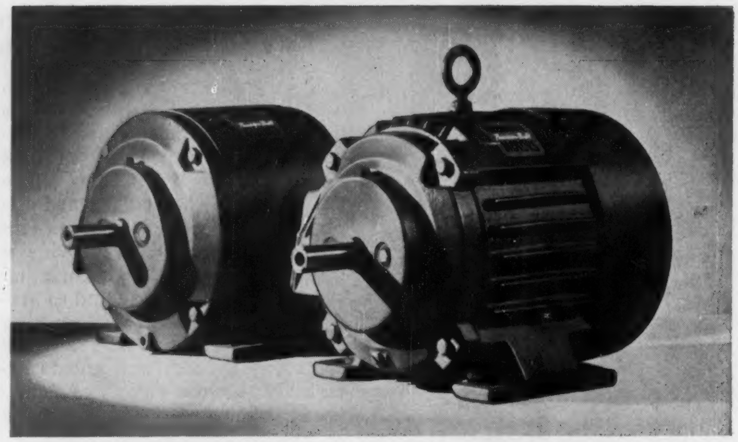


"Hardclad" radial drill brought out by the Cincinnati Lathe & Tool Co.

port, securely bolted to the base, is equipped with heavy-duty, antifriction bearings.

The radial arm of this machine is 3 feet long and the column, 7 1/2 inches in diameter. The drilling capacity is 1 1/2 inches in cast iron, and holes can be drilled to the center of a circle 77 inches in diameter. Accessories such as coolant reservoir, universal tables, side bases, and work-light are available for this new machine.

Circle Item 136 on postcard, page 253



(Left) Reliance protected alternating-current motor. (Right) Enclosed fan-cooled alternating-current motor.

Reliance Totally Protected Alternating-Current Motors

The Reliance Electric & Engineering Co., Cleveland, Ohio, has brought out a new line of totally protected alternating-current motors designed to combine a pleasing symmetrical appearance, rugged construction, and precision performance. These motors have solid-cast frames and plastic sleeving that protects brazed coil connections.

Regardless of the mounting positions, these motors offer complete protection against drip, splash, and falling objects. Ventilation louvers are located in high, dry positions in the end brackets. The frame extends beyond the coil heads to give full protection to the windings. Compact, rugged brackets insure shockproof shaft support. Neoprene gaskets afford a positive seal between the frame and conduit box.

Three styles of these enclosed motors are available for use in the metal-working, chemical, petroleum, and textile industries. They are of the fan-cooled, corrosion-proof, and explosion-proof designs. Each design has been developed to withstand the hazards encountered in specific applications.

Circle Item 137 on postcard, page 253

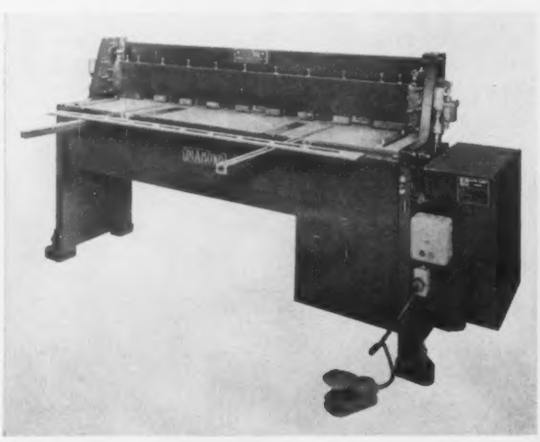
Diamond Power Squaring Shears

The Diamond Machine Tool Co., Pico, Calif., has announced that its power squaring shear has been redesigned so that it will stall rather than break in the event that it is subjected to overloading. The machine is now provided with silent herringbone gearing, electric clutch, centralized lubrication, triangulated ram, and box type bed. It will cut 10-gage mild steel or stainless steel in lengths up to 73 inches. The shearing speed is 80 strokes per minute. A compressed air operating pressure of 60 to 200 pounds per square inch is required. The drive is by a 5-H.P. motor operating at 1800 R.P.M. The machine weighs 4800 pounds.

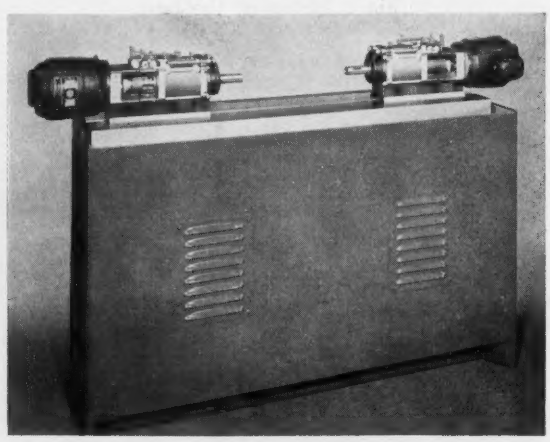
Circle Item 138 on postcard, page 253

Universal Double-End Machine Base for Drilling and Tapping Units

The M23C-1 universal double-end machine base, shown equipped with two Holomatic drill units in the accompanying illustration, was designed by Hause Engineering, Montpelier, Ohio, to simplify the building of automation-type special machines for drilling, or drilling and tapping opposed holes. Special set-ups incorporating two



Power squaring shear of improved design made by the Diamond Machine Tool Co.



Hause universal double-end machine base for mounting drilling and tapping units

For more information on products advertised, use Inquiry Card, page 253

Holomatic drill units with standard hand- or air-operated clamps, index-tables, shuttle tables, trunnion fixtures or multiple-spindle heads can easily be adapted to the base. Set-ups can be readily made for centering operations. This type of set-up can be used for parts with holes from 1/2 inch to 24 inches apart.

The cast semi-steel top is 12 inches wide, 60 inches long, 4 inches thick and has a precision ground top to assure surface accuracy. A 1-inch keyway running the full length of the top provides accurate alignment of fixtures and machine components. Four leveling assemblies are provided for leveling the top to the base and another four are provided for leveling the base to the floor. A large accessible area is provided for chip collection. The bottom of this area is tapered to a screened outlet for coolant drainage. An opening in the rear of the base permits internal mounting of a removable coolant pump-reservoir system.

Circle Item 139 on postcard, page 253

Eight-Station Index Machine for Welding Operations

An eight-station index machine designed for a wide variety of spot-, projection-, and arc-welding operations is now available from the Expert Welding Machine Co., Detroit, Mich. This machine has a mechanical drive and will produce up to 720 welded assemblies per hour. It consists primarily of a welded steel frame, a standard or special welding head, an electrical control cabinet, a 24-inch index-table and a 1/2-H.P. motor-driven mechanical drive enclosed in the base of the machine. Operation consists of manual loading, automatic index cycle, and automatic part ejection.

The machine can be adapted for a variety of welding operations requiring six or more indexes by changing the cam and follower plate. The enclosure at the side of the machine houses the control panel, welding contactor and disconnect switch. The welder illustrated spot-welds stamped steel automotive engine oil breather assemblies at a rate of 720 pieces per hour.

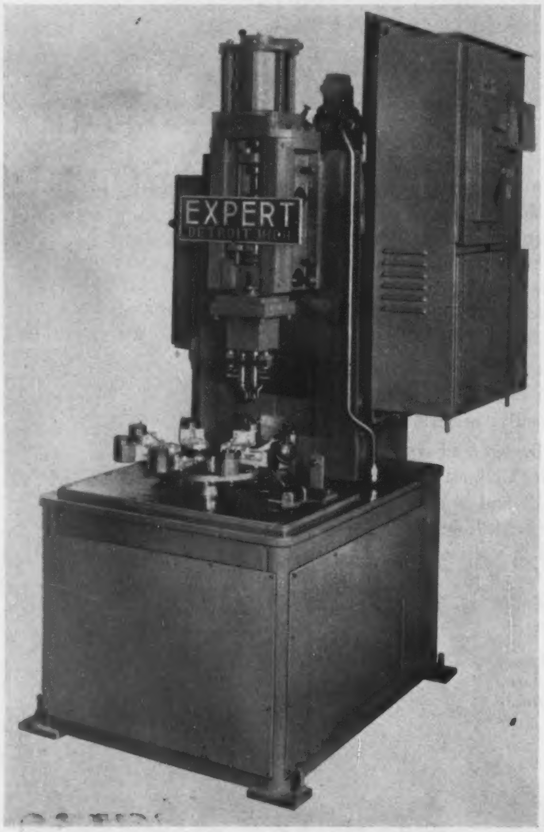
Circle Item 140 on postcard, page 253

Covel Optical Comparator

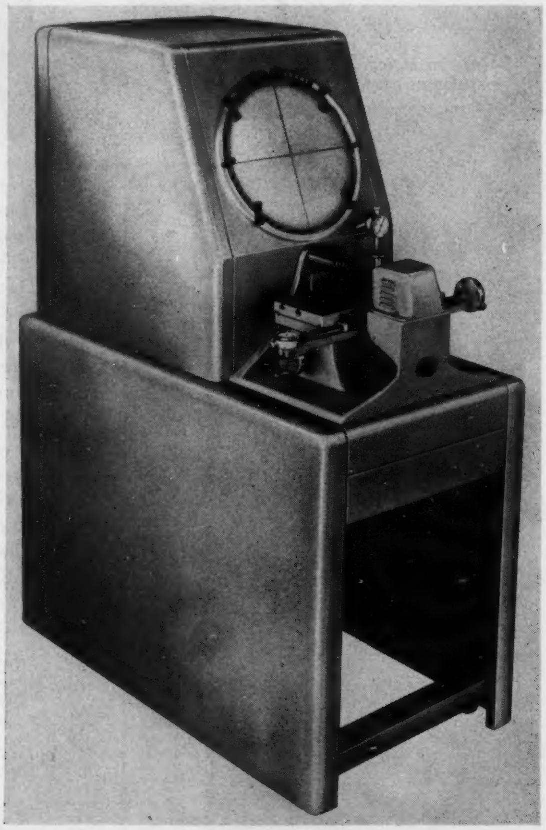
A contour projector or optical comparator developed to permit quick, economical, precision inspection in the shop is now available from the Covel Mfg. Co., Benton Harbor, Mich. This No. 14 optical comparator is a complete instrument which provides means for accurate measurement of dimensions that are difficult to check by other methods. It is simple to operate, all measurements being taken by direct readings.

Large work capacity, sturdy, precision construction and an optical arrangement that permits it to be used in bright light in the shop are features of this equipment. The optical elements are precision ground and coated to give extreme accuracy, and bright, halo-free images.

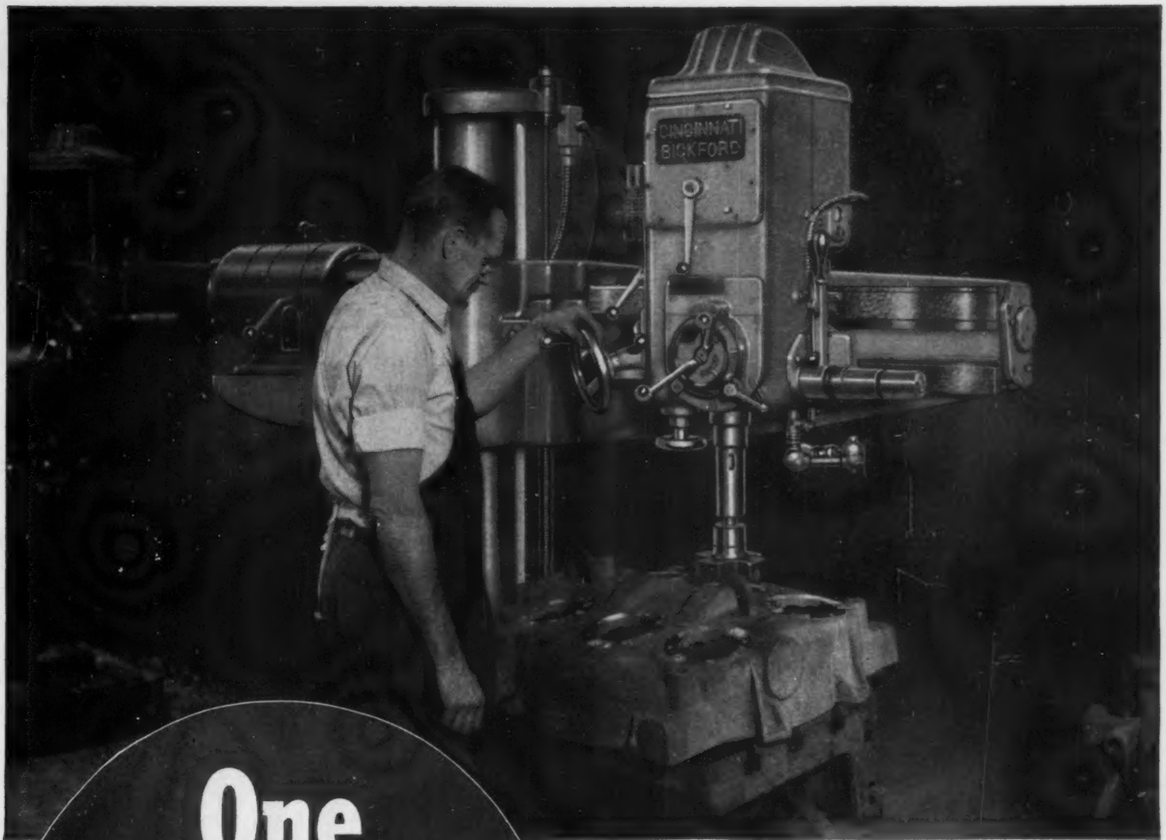
Circle Item 141 on postcard, page 253



Welding machine with eight-station index-table made by Expert Welding Machine Co.



Optical comparator for precision inspection in shop brought out by Covel Mfg. Co.



One set-up saves 30%

Photos courtesy of the Kelman Electric & Mfg. Company, Los Angeles, California.

Boring, facing, and high speed drilling with one set-up cut the floor to floor time about one-third on this job.

The Kelman Electric & Mfg. Company say their Cincinnati Super Service Radial Drill "handles easily, is very accurate and versatile."

They are facing 6" diameters; drilling for ½" bottom tap, and tapping with a ½" bottom tap on this job.

The part being processed is a Bronze Top Casting.

Cincinnati Super Service Radial Drills are profit makers in this shop, and they could be in yours.

Write for Bulletin R-21C

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

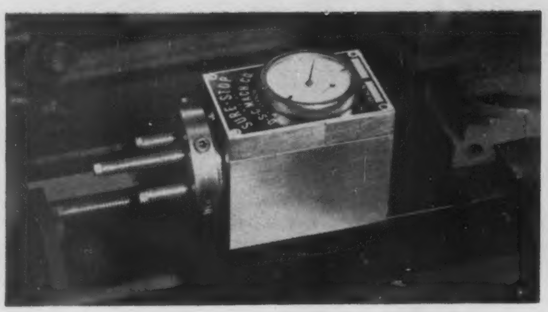


Fig. 1. D-S-C "Sure-Stop" developed for use on lathes

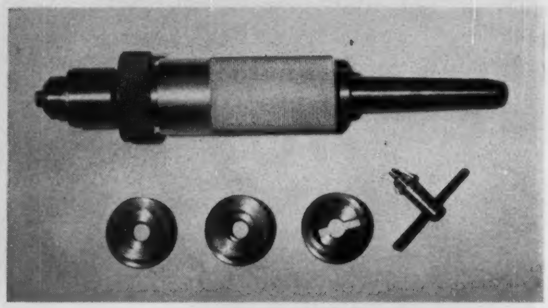


Fig. 2. "Thread-Quill" and accessories used with it

D-S-C "Sure-Stop" Device and Threading Quill

A "Sure-Stop" device for lathes, Fig. 1, designed to maintain close length tolerances in the duplication of machined parts, and a "Thread-Quill," Fig. 2, for use in threading, tapping and drilling are recently announced products of the D-S-C Machine Co., Mount Vernon, N. Y.

The Sure-Stop has five quickly and easily adjustable stops which cover a wide range of machining operations. The unit is mounted on the carriage of the lathe and is used in conjunction with a stop mounted on the lathe bed. The dial indicator has a measuring range of 0.150 inch and has 0.001-inch graduations. A center dial permits reading the accumulated number of rotations of the needle. To assure easy readability of settings, movable limit stops are mounted on the indicator. Although primarily designed for use on lathes, this unit can be adapted for milling machines and drill presses.

The Thread-Quill, seen in Fig. 2, makes it possible to control the forward travel of a drill, tap or die, and "feel" any delay in the cutting action. A pressure release allows the tool and sleeve to spin with the work-piece. The turret, or tailstock, remains stationary. By grasping the knurled surface of the Thread-Quill, the operator can move the drill, tap or die forward manually.

The lateral travel on the tool is 1 1/2 inches. A recess in the back of the chuck adapter locates the device on the center line of the spindle. The Thread-Quill comes supplied with a chuck (for drilling) and three button die adapters having diameters of 5/8, 13/16, and 1 inch.

Circle Item 142 on postcard, page 253

Wire Straightening and Cutting Machine

Fast, accurate and economical operation are advantages claimed for the 2-C type wire straightening and cutting machines made by the Lewis Machine Co., Cleveland, Ohio. Two models are available, No. 2-C3 for wire from 1/16 to 3/16 inch in diameter, and No. 2-C4 for wire from 3/32 to 1/4 inch in diameter. Heavy section V-belts with large pulleys, flush-mounted electric control buttons, and a high-speed five-die straightener arbor mounted on ball bearings are features of these machines.

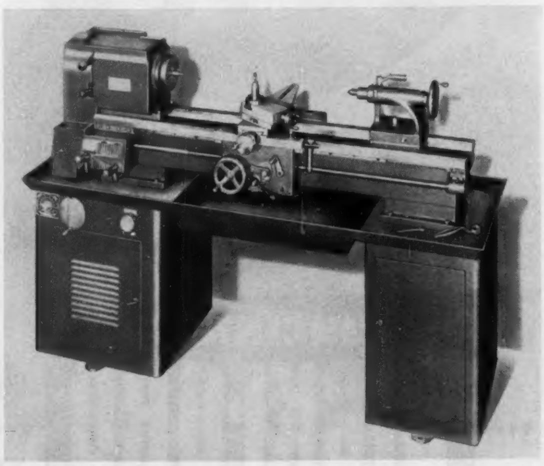
A solenoid-operated trip mechanism is available and is recommended for small diameter wire sizes. These wire machines are designed to process all commonly used materials.

Circle Item 143 on postcard, page 253

Logan Lathe with Variable-Speed Drive

A 14-inch swing lathe with variable-speed drive having a spindle speed range of 38 to 1200 R.P.M. is being made available through its dealers, by the Lathe

Wire straightening and cutting machine manufactured by the Lewis Machine Co.



Lathe with variable-speed drive brought out by the Lathe Division, Logan Engineering Co.

For more information on products advertised, use Inquiry Card, page 253

Division, Logan Engineering Co., Chicago, Ill. The principal specifications of this No. 6560 lathe are: swing over bed 14 1/2 inches; swing over saddle 9 inches; diameter of spindle hole, 1 3/8 inches; collet capacity, 1 inch, and distance between centers, 40 inches. This lathe is designed for tool-room as well as production and maintenance work.

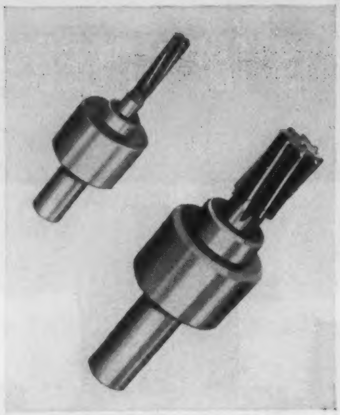
The spindle turns on two double rows of over-size ball bearings. The bed is 68 inches long by 10 inches wide, and has two V-ways and two flat-ways which are precision ground. Other design features include heavy precision carriage, double-walled apron and disc type clutch. Rotating members of the lathe and the 2-H.P. motor are dynamically balanced as a complete unit

Circle Item 144 on postcard, page 253

Delpark-Dings Magnetic Coolant Separator

A line of Delpark-Dings magnetic separators, designed to remove metal particles from coolants, has been announced by the Industrial Filtration Co., Lebanon, Ind. The magnetic coolant separators in this new line are adapted for use on honing, lapping, grinding, shaving, broaching and milling machines. They can also be used on metal-rolling mills, in glass polishing, and other processes where the metallic particles to be separated respond to magnetic attraction.

Circle Item 145 on postcard, page 253



Scully-Jones floating tool-holders for taps and reamers

Floating Tool-Holders

A line of floating tool-holders designed to improve the accuracy of reaming and tapping operations performed on turret lathes and automatics has been announced by Scully-Jones & Co., Chicago, Ill. This is the first application to screw machine and turret lathe work of the double-engagement spline drive principle used successfully in other Scully-Jones floating holders. It is essentially a balanced, constant velocity, flexible-drive coupling, in which the floating and driving elements are completely independent, and permit unrestricted movement in floating the tool into proper alignment.

When reaming, the tool follows the drilled or bored hole accurately, eliminating bell-mouthed, out-of-round, and poorly finished holes. When used for driving taps, the floating holder guards against production of over-sized and tapered threads, and helps increase tool life.

Taps and reamers are mounted in the straight collet either directly or in special bushings, and are locked in place by a socket head cap-screw. Five standard "JS" floating holders are now in production, with collet hole diameters ranging from 3/8 inch to 1 1/2 inches.

Circle Item 146 on postcard, page 253

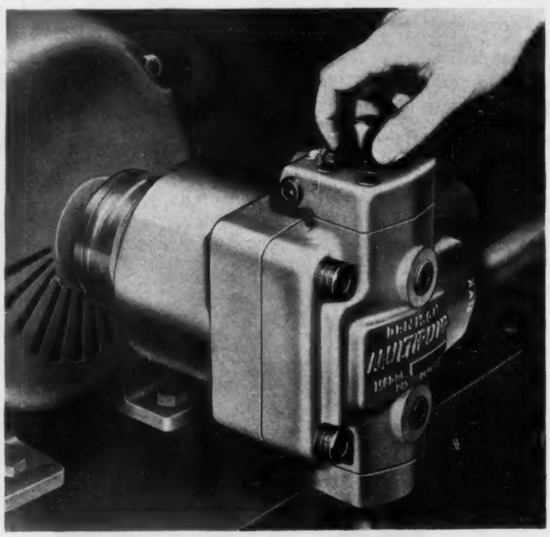
Denison Multipump for Oil-Hydraulic Applications

A variable-volume pump of vane type construction, designated the Multipump, has been brought out by the Denison Engineering Co., Columbus, Ohio. This pump incorporates in one compact unit many operating features previously obtained only through the use of separate components such as flow controls, relief valves, and the second pump used in dual pump circuits. The new pump is available in three basic sizes with capacities of 5, 15, and 25 gallons per minute at a speed of 1200 R.P.M. All three sizes are designed for operation at 1000 pounds per square inch continuous duty.

Variable delivery is obtained by finger-tip pressure on the control knob. With this control, changes in delivery can be made from near

(Continued on page 238)

Delpark-Dings magnetic coolant separator



Denison Multipump for oil-hydraulic applications

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For more information on products advertised, use Inquiry Card, page 253

HARDNESS AND STRENGTH OF WROUGHT ALUMINUM ALLOYS—1

Hardness Ratings—A list of the various aluminum alloys and tempers arranged in the order of their increasing hardness is often helpful in selecting materials for new or replacement parts. Such a list facilitates direct comparisons and the selection of an alloy and temper best adapted for a given part or specific application. In Table 1 are listed all the common wrought aluminum alloys and tempers from the softest to the hardest with their respective Brinell hardness ratings. The clad alloys are not included in this listing because Brinell hardness is a measure of the resistance to penetration. This is usually determined for aluminum alloys by impressing a ball 10 millimeters in diameter into the surface of the material with a 500-kilogram load gradually applied.

In Brinell hardness testing of the Alclad wrought aluminum alloys, the soft cladding material at the test point is pressed out and away from the 10-millimeter ball so that it is the hardness of the core material that is actually measured. Therefore, the Brinell hardness of Alclad alloys should be approximately equal to the hardness value for the same alloys without cladding and having the same temper designations. For example, Alclad 4S-H32 would indicate the same Brinell hardness as 4S-H32, Alclad 24S-T36 and 24S-T36 would have the same Brinell hardness, and Alclad 75S-O the same as 75S-O.

Table 1. Wrought Aluminum Alloys in Order of Increasing Hardness

Alloy and Temper*	Brinell Hardness†	Alloy and Temper*	Brinell Hardness†	Alloy and Temper*	Brinell Hardness†
2S-O	23	24S-O	47	4S-H38	77
2S-H12	28	50S-H34	50	A54S-H36	78
3S-O	28	305-H38	51	63S-T83	82
R305-O	28	C57S-H36	51	A54S-H112	83
61S-O	30	4S-H32	52	52S-H38	85
62S-O	30	3S-H18	55	11S-T3	95
2S-H14	32	50S-H36	55	B18S-T72	95
C575-O	32	C57S-H38	55	61S-T6	95
3S-H12	35	A54S-O	58	62S-T6	95
50S-O	35	75S-O	60	63S-T832	95
R305-H32	36	52S-H32	62	11S-T8	100
2S-H16	38	4S-H34	63	A51S-T6	100
3S-H14	40	50S-H38	63	14S-T4	105
C57S-H32	40	56S-O	65	17S-T4	105
R305-H34	41	61S-T4	65	56S-H18	105
63S-T42	42	62S-T4	65	56S-H38	105
2S-H18	44	63S-T5	65	25S-T6	110
4S-O	45	52S-H34	67	18S-T61	120
14S-O	45	A54S-H32	67	24S-T3	120
17S-O	45	4S-H36	70	24S-T4	120
50S-H32	45	A17S-T4	70	32S-T6	120
52S-O	45	63S-T831	70	24S-T36	130
C57S-H34	45	A54S-H34	73	14S-T6	135
R305-H36	46	63S-T6	73	75S-T6	150
3S-H16	47	52S-H36	74		

*For the new designations for alloy and temper see Data Sheets in September, 1954, MACHINERY, page 255.
†500 Kg. load; 10-millimeter ball.

Strength Ratings—Ultimate strength and yield strength are important or determining factors in the selection of the material for many parts or structures. A listing of wrought aluminum alloys and tempers in the order of their increasing ultimate strength, Table 2, facilitates selecting the best material for a specific purpose.

The difference between the ultimate strength and the yield strength—also given in the table—is the range through which elongation or plastic deformation takes place. Thus the range between ultimate strength and yield strength affords a measure of formability. In other words, if two alloys have approximately the same ultimate strength, the one with the lower yield strength can be formed more readily.

Similarly, if two alloys have approximately the same yield strength, the alloy with the greatest ultimate strength will have better formability characteristics.

Compiled by Reynolds Metals Co.

MACHINERY'S DATA SHEET

HARDNESS AND STRENGTH OF WROUGHT ALUMINUM ALLOYS—2

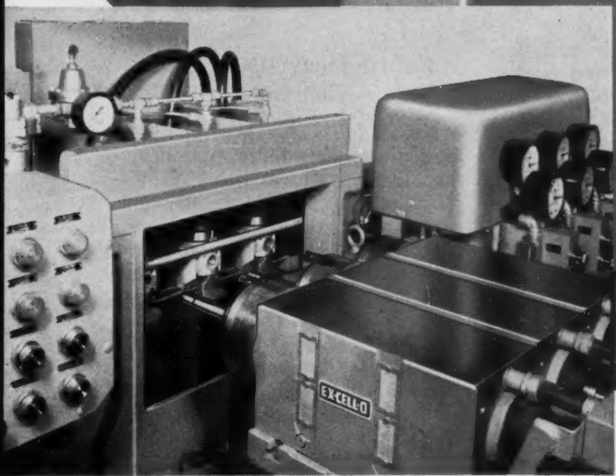
Table 2. Wrought Aluminum Alloys in Order of Increasing Ultimate Strength

Alloy and Temper*	Ultimate Strength, Pounds per Square Inch †	Yield Strength, Pounds per Square Inch †
EC-O	12,000	4,000
1100-O	13,000	5,000
1100-H12	15,500	14,000
3003-O	16,000	6,000
5005-O	17,000	6,000
6062-O	17,000	6,500
6061-O	17,000	7,000
Alclad 6061-O	18,000	8,000
1100-H14	18,000	16,000
5357-O	19,000	7,000
3003-H12	19,000	17,000
6951-O	20,000	.....
6951-T4 (Air)	20,000	6,500
5050-O	20,000	8,000
6951-T3	20,000	13,000
5005-H32	20,000	17,000
5005-H12	20,000	19,000
1100-H16	21,000	19,000
6063-T42	22,000	13,000
5357-H32	22,000	19,000
3003-H14	22,000	20,000
5005-H34	23,000	20,000
5005-H14	23,000	22,000
1100-H18	24,000	22,000
5050-H32	24,500	20,500
Alclad 3004-O	25,000	9,000
Alclad 2014-O	25,000	10,000
6951-T4 (Water)	25,000	11,000
5357-H34	25,000	22,000
3004-O	26,000	10,000
2017-O	26,000	10,000
Alclad 2024-O	26,000	11,000
3003-H16	26,000	24,000
5005-H36	26,000	24,000
5005-H16	26,000	25,000
2024-O	27,000	11,000
2014-O	27,000	14,000
EC-H19	27,000	24,000
5050-H34	27,500	24,000
5052-O	28,000	13,000
5357-H36	28,000	26,000
6951-T6 (Air)	29,000	18,000
5050-H36	29,000	26,000
3003-H18	29,000	27,000
5005-H18	29,000	28,000
Alclad 3004-H32	30,000	21,000
6063-T5	30,000	25,000
5005-H38	30,000	28,000
3004-H32	31,000	22,000
5050-H38	31,500	29,000
Alclad 7075-O	32,000	14,000
Alclad 6061-T4	32,000	19,000
6063-T831	32,000	29,000
5357-H38	32,000	30,000
7075-O	33,000	15,000
Alclad 6061-T4	33,000	19,000
Alclad 3004-H34	33,000	26,000
5154-O	34,000	15,000
3004-H34	34,000	27,000
5052-H32	34,000	27,000
5154-H112	35,000	16,000
6061-T4	35,000	21,000
6062-T4	35,000	21,000
6063-T6	35,000	30,000
Alclad 3004-H36	36,000	30,000
3004-H36	37,000	31,000
5052-H34	37,000	31,000
Alclad 5055-O	38,000	20,000
Alclad 3004-H38	38,000	33,000
6063-T83	38,000	36,000
Alclad 5055-H111	39,000	24,000
5154-H32	39,000	29,000
6951-T6 (Water)	39,000	34,000
5052-H36	39,000	34,000
3004-H38	40,000	34,000
5052-H38	41,000	36,000
Alclad 6061-T6	41,000	36,000
5056-O	42,000	22,000
5154-H34	42,000	33,000
Alclad 6061-T6	42,000	37,000
2117-T4	43,000	24,000
5154-H36	45,000	36,000
6061-T6	45,000	40,000
6062-T6	45,000	40,000
6063-T832	45,000	40,000
5154-H38	47,000	39,000
Alclad 5055-H34	48,000	36,000
2218-T72	48,000	37,000
6151-T6	48,000	43,000
2218-T71	50,000	40,000
Alclad 5055-H36	52,000	40,000
2218-T61	55,000	40,000
4032-T6	55,000	46,000
2011-T3	55,000	48,000
2025-T6	58,000	37,000
2011-T8	59,000	45,000
5056-H38	60,000	50,000
Alclad 2014-T4	61,000	37,000
2018-T61	61,000	46,000
2014-T4	62,000	40,000
2117-T4	62,000	40,000
Alclad 2014-T3	63,000	40,000
5056-H18	63,000	59,000
Alclad 2024-T4	64,000	42,000
Alclad 2024-T3	64,000	44,000
2618-T61	64,000	54,000
Alclad 2024-T81	65,000	60,000
Alclad 2024-T36	67,000	53,000
2024-T4	68,000	48,000
Alclad 2014-T6	68,000	60,000
2024-T3	70,000	50,000
2014-T6	70,000	60,000
Alclad 2024-T86	70,000	66,000
2024-T36	73,000	57,000
Alclad 7075-T6	76,000	67,000
7075-T6	82,000	72,000

*For the old designations for alloy and temper see Data Sheets in September, 1954, MACHINERY, page 255.
†500 Kg. load; 10-millimeter ball.

Compiled by Reynolds Metals Co.

Style 112-C Ex-Cell-O Precision Boring Machine equipped for automation. Operations: Transfer mechanism moves three parts at a time from conveyor to fixture, to gaging station (optional), back to conveyor.



Net production is 300 pieces per hour. Three pistons are machined simultaneously by three motorized spindles each carrying semifinish and finish boring tools.

Standard EX-CELL-O Machine Equipped for AUTOMATION

FAST, ACCURATE PRECISION BORING OF WRIST PIN HOLES

Pistons are brought automatically from the conveyor to boring position, three at a time. Operations are fast and accurate, producing a fine finish.

Automatic Inspection equipment may be incorporated, with lights to indicate size limit warnings and rejections; a rejection stops the machine.

Call your Ex-Cell-O representative or write Ex-Cell-O in Detroit for complete facts on this or similar production savings opportunities through automation.

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EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

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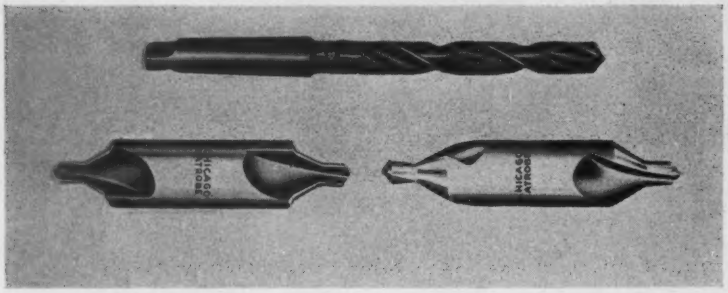
- GRINDING SPINDLES • CUTTING TOOLS
- RAILROAD PINS AND BUSHINGS
- DRILL JIG BUSHINGS
- AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS
- DAIRY EQUIPMENT

55-12



Chicago-Latrobe high-speed steel drills and combined drills and countersinks

zero to the full rated volume. When the pump is set for a specific delivery rate, the volume remains constant within approximately plus or minus 5 per cent, regardless of pressure fluctuations.

When the compensation control is in use and the pressure rises to a pre-set maximum, the pump delivery volume is reduced to the minimum needed to maintain the system pressure. An optional minimum stop is available for all models to limit this reduced delivery to a predetermined amount. Any flow in excess of that needed by the circuit is then returned to the tank at zero pressure, resulting in a saving in power and elimination of the relief valve used in many circuits employing a constant delivery pump.

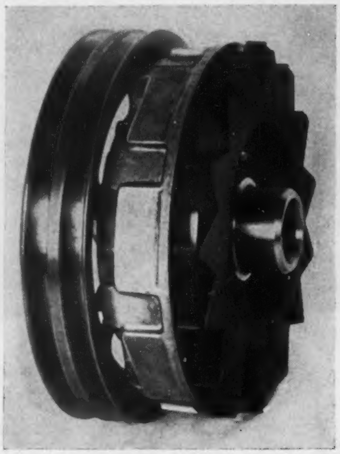
Circle Item 147 on postcard, page 253

High-Speed Steel Drills, and Combined Drills and Countersinks

Chicago-Latrobe, Chicago, Ill., has brought out a line of type No. 710 heavy-duty drills designed for the "tougher than average" jobs of drilling hardened materials, such as heat-treated steels, steel forgings, and steel castings. These drills are made of high-speed steel in sizes ranging from 1/8 inch through 1 1/2 inches in diameter.

Chicago-Latrobe has also announced a line of combined drills and countersinks made with spiral flutes, which can now be furnished in the plain type and in sizes No. 1 to No. 18 in carbon and high-speed steels. Bell types are made in sizes No. 11 to No. 18 in high-speed steel only. All regular or plain and bell type countersinks are made with an included angle of 60 degrees. The bell type countersinks have a 120-degree bell angle. The drill sizes range from 3/64 through 1/4 inch and the length of the drill portion equals that of the drill diameter.

Circle Item 148 on postcard, page 253



Lipe friction coupling for controlling speed and torque of power-operated automobile accessories

Lipe Friction Coupling

A coupling designed to balance or control speed and torque has been announced by Lipe-Rollway Corporation, Syracuse, N. Y., to assist in solving some of the problems introduced by the increasing tendency to replace hand-actuated devices with power-operated mechanisms.

Power-actuated automobile accessories, for example, such as power steering mechanisms, automobile window and seat lifts, fans, pumps, and generators consume engine power that might well be transferred to the rear wheels. At 60 miles per hour a perfectly functioning automobile engine cooling fan driven in the conventional manner revolves three times faster than it does at 20 miles per hour, but it pulls about twenty-six times more power from the engine.

The new speed-torque metering coupling is said to eliminate this power drag of automobile accessories, as well as that of power-operated drives on trucks, buses, and stationary units. When placed between the engine and driven accessories, the coupling acts as a speed control, allowing driven units to operate efficiently over a wide range of driving speeds. It serves also as a shock absorber and torque-limiting device for the protection of the equipment.

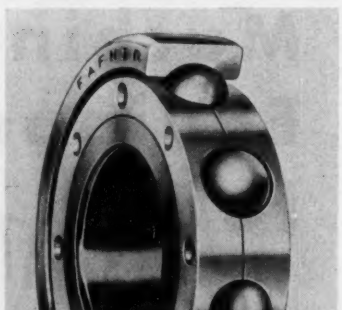
Circle Item 149 on postcard, page 253

Fafnir Heavy-Duty Ball Bearings

Heavy-duty ball bearings designed especially for woodworking machinery are now being manufactured by the Fafnir Bearing Co., New Britain, Conn. Designated the M300 series, these bearings are of the single-row, radial type manufactured to special precision tolerances. They feature the Fafnir "balanced design" which incorporates the correct combination of ball diameter, race depth and ring section for long, trouble-free service. The non-filling slot type construction is said to assure dependability under radial, thrust and combined loads at high speeds.

This series of bearings are made with two types of retainers, depending on the size of the bearing. One is a composition type, the other a machined bronze retainer. The composition retainer is used on the three smallest sizes in the series.

Circle Item 150 on postcard, page 253



Heavy-duty ball bearing of balanced design made by Fafnir Bearing Co.

FOR AUTOMATIC CYCLES IN PRODUCTION MACHINES:

Ex-Cell-O Quill-Type Power Units

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EX-CELL-O *for* PRECISION

THE MACHINE TOOL SHOW
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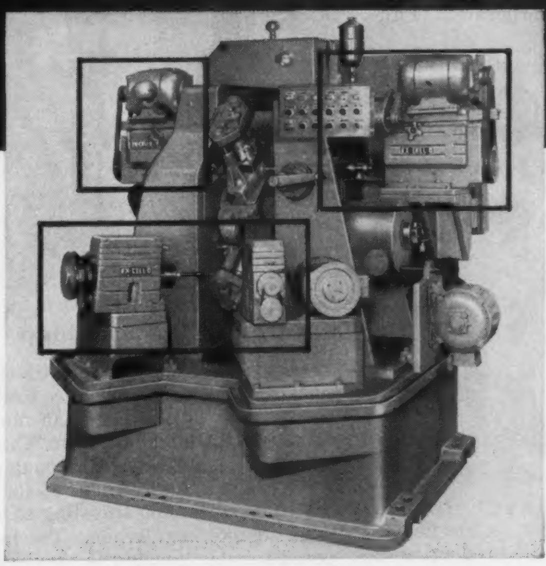

This special machine with automatic indexing fixture core-drills piston pin holes and drills angular oil holes. It uses six Ex-Cell-O Power Units (shown without belt guards) operated from a central push-button station.

Ex-Cell-O Hydraulic Power Units feed and rotate cutting tools in easily controlled automatic cycles. They actuate single tools or multiple spindle heads for such operations as drilling, reaming, counterboring and spot-facing. Hydraulic operation provides smooth, powerful movements.

A machine utilizing Ex-Cell-O Power Units can be very simple, with manual loading and clamping. Or it can be designed with work handling equipment for automation . . .

For complete information, including specifications and installation drawings, ask your Ex-Cell-O Representative or write Ex-Cell-O in Detroit.

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55-13

Capacitrol for Controlling Plastic Processing Machines

Wheelco Model 297 Capacitrol of small, compact design for accurate indicating and instantaneous control of new plastic machines, methods, and materials announced by Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill. This rugged, easily serviced instrument uses plug-in components for both the temperature measuring system and the control chassis, permitting quick removal of

either unit for replacement or servicing without disturbing other components or external wiring.

Circle Item 151 on postcard, page 253

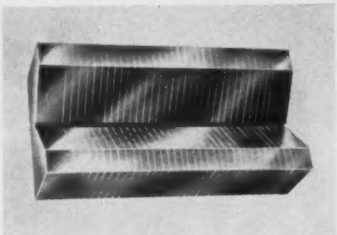
Titanium Tension Bolt

Light-weight titanium bolt that equals or exceeds the performance of present-day, high-strength steel aircraft bolts, announced by the Standard Pressed Steel Co., Jenkintown, Pa. Although only 57 per cent as heavy, this Hi-Ti bolt is stronger in fatigue than a comparable high-strength steel bolt.

Circle Item 152 on postcard, page 253

V-Blocks and Parallels for Magnetic Chucks

The grinding of irregularly shaped work is facilitated with V-blocks and parallels for magnetic chucks introduced by the Hanchett Magna-Lock Corporation, Big Rapids,

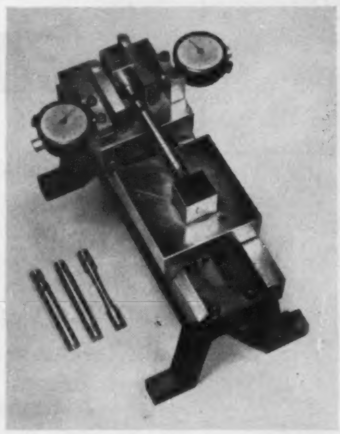


Mich. These devices are of welded construction, with alternate laminations of 1/32-inch non-magnetic steel and 1/8-inch low-carbon steel which cannot shift.

Circle Item 153 on postcard, page 253

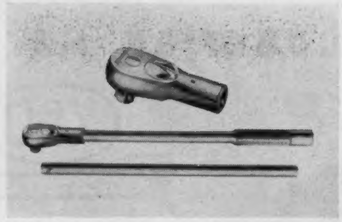
Fixture for Checking Test Specimens

Inspection fixture for checking the taper and concentricity of specimens to be tested in the R. R. Moore high-speed fatigue-testing machine, announced by Baldwin-Lima-Hamilton Corporation, Phil-



adelphia, Pa. This fixture is designed to assure the production of specimens to dimensional tolerances which will prevent vibration during tests thus reducing the cost of testing machine maintenance. The fixture can be used to set-up a lathe or grinder for making specimens with tapered ends of the required accuracy.

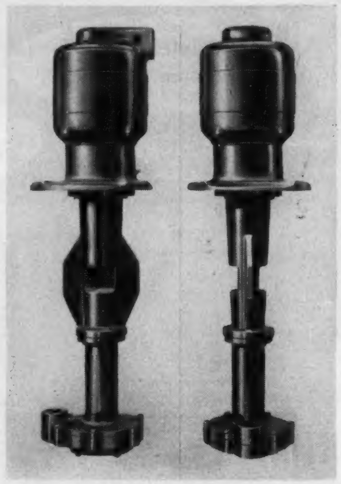
Circle Item 154 on postcard, page 253



Williams Ratchet Head

Heavy-duty ratchet head added to the line of industrial and automotive wrenches, tools and drop-forgings manufactured by J. H. Williams & Co., Buffalo, N. Y. This 3/4-inch square ratchet head is drop-forged from selected alloy steel, fully heat-treated for added strength and finished in satin chromium-plate. Its heavy-duty ratchet gear is made with twenty-four teeth for quicker, smoother action. A shift lever reverses the ratchet action instantly.

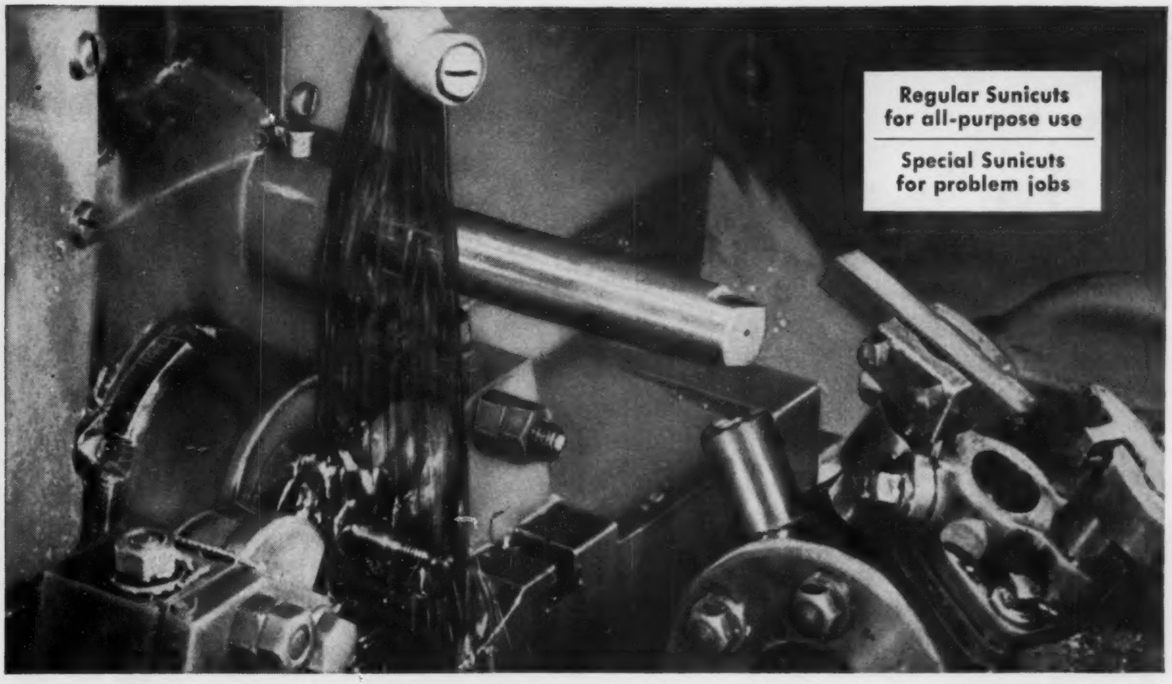
Circle Item 155 on postcard, page 253



Ruthman Gusher Pump

Vertical ball-bearing motor-driven coolant pump for machine tools brought out by the Ruthman Machinery Co., Cincinnati, Ohio. This Model "TL-15025K" gusher pump is arranged for center coolant trough mounting on traveling base machine-tool installations. The tapered tubular housing is provided with a reinforced narrow section for passage through the limited width slot in the trough cover. Liquids contaminated by dirt, grit and abrasives can be handled without injury to the pump. Available with 1/2-, 3/4-, or 1-H.P. motor.

Circle Item 156 on postcard, page 253



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Your Sun representative has the practical know-how to analyze *your* problems. Working with Sun's experienced engineering staff, he's ready to help you pick the Sunicut oil that will give you the tolerances and finishes you want.

The Sunicut series for screw machines is only part of a large selection of non-emulsifying and emulsifying cutting oils available to help you get peak production at the lowest possible cost.

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For more information on products advertised, use Inquiry Card, page 253

Between Grinds

By E. S. Salichs

Flat Fire

To find the exact temperature at all points of a flame, Westinghouse scientists have produced a saucer of flame in a vacuum chamber, thus measuring temperature more exactly than is possible in an ordinary cone of fire. The experiment may hold the key to faster jet engines or better furnaces, it is said.

The Lady and Her Lives

The *Pacific Queen*, a 19th century sailing ship, is being restored by the San Francisco Maritime Museum to seaworthy condition. More than twenty-five companies and labor unions have given their goods and services; for example, the Wickwire Spencer Steel Division of the Colorado Fuel & Iron Corporation donated rope. The Queen has had an unusual career. She sailed under nearly half a dozen names, then won sailing races, and later became a floating poker parlor, a set for movies (including Mutiny on the Bounty), and a pirate ship in a world's fair exhibit.

Clear as a Bell

Every 40 miles along the ocean floor, electronic amplifiers are being laid by the American Telephone & Telegraph Co.—under the Atlantic to Europe and under the Pacific to Alaska. Soon, man's voice will be heard by telephone cable strong and clear, the result of more than twenty years of study and experiment.

Lost Case, But Not Face

A public relations man, it was reported in *Business and Taxes*, bought his wife a mink coat because she had to attend a meeting with him where the wives of customers would be present, also in mink coats. He had been convinced by his wife that it was the businesslike thing to do. Naturally he added this expense to his income tax in the usual manner. The Tax Court refused to allow him to deduct depreciation, claiming the mink coat was not like a uniform; it was for personal as well as business use.

Claiming Coincidence

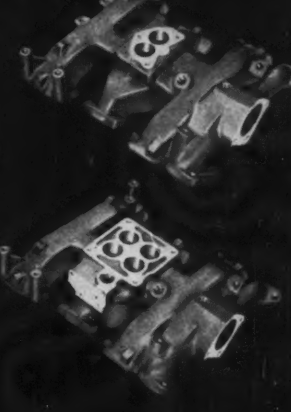
An old April Fool's gag was enacted in the Editor's office on April 1. That fateful morning, the Editor had some correspondence with S. C. Baer of Cincinnati, as well as a discussion with someone about the Behr Agency, also of Cincinnati. Upon returning from lunch, there was a notation on his desk to call a certain number and ask for B. Bear. He did so. Naturally it was the Bronx Zoo.

GUARDING AGAINST RETIRED BOREDOM—Spectators watch Norton employe, Franklin Drake, form a vase on potter's wheel at Art and Handcrafts Show sponsored by the Norton Co., Worcester, Mass. Aim was to stimulate employe's interest in hobbies before they retire, and reportedly it hit the mark. More than 100 employes who exhibited what they have been doing, are now helping co-workers eager to get into clay molding, oil painting, wood carving, and ship modeling, to mention some of the activities.

Another Transfer-matic by Cross

Mills, Drills, Bores, Taps, 2 and 4 Barrel Intake Manifolds

- ★ Rough and finish mills carburetor pad; mills choke pad (4 barrel only); bores carburetor port holes; drills and chamfers all holes (except 3 holes in water outlet pad); and taps all holes.
- ★ 140 pieces per hour at 100% efficiency.
- ★ Initial part location from port openings.
- ★ Push-button changeover from 2 to 4 barrel carburetor.
- ★ 13 stations; 1 loading, 11 working, 1 unloading.
- ★ Lift-and-carry type transfer mechanism.
- ★ Pre-set tooling throughout.
- ★ Other features: construction to J.I.C. standards; complete interchangeability of all standard and special parts for easy maintenance; hardened and ground ways; drag chain type chip conveyor.



Established 1898

THE **CROSS** CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 253

News OF THE INDUSTRY

California and Texas

JOE A. JEAN has been named special factory sales representative for the new Axelson milling machine by Axelson Mfg. Co., Division of U. S. Industries, Inc., Los Angeles, Calif. Mr. Jean was formerly associated with the sales department of the Pratt & Whitney Division of the Niles-Bement-Pond Co. for ten years.

JOHN R. HOWELL has been made vice-president in charge of sales of Sterling Electric Motors, Inc., Los Angeles, Calif. He has been with the company for twenty-seven years, and has served as sales manager since 1954.

NORTON CO., Worcester, Mass., has announced that its Los Angeles, Calif., district office has moved to 5905 Pacific Blvd., Huntington Park, Calif. ROBERT W. CUSHMAN is West Coast district manager for the company.

PHILIP F. THAYER was recently elected vice-president and general manager of the Metals Division of General Metals Corporation, San Francisco, Calif.

FIRTH STERLING, INC., Pittsburgh, Pa., has acquired the assets of the Houston Carbide Corporation of Houston, Tex. The company will be operated as a division of Firth Sterling, Inc., with its existing organization unchanged. The plant is completely equipped for pressing, sintering, and shaping a wide variety of carbide products.

Illinois

WHEELCO INSTRUMENTS DIVISION, BARBER-COLMAN CO., Rockford, Ill., announces the following appointments: H. V. KING, formerly of the Chicago Wheelco office, has now joined the sales and service department of the Philadelphia office, and HAROLD SIEBER has also joined this department in the Philadelphia office. D. COMBELLACK, formerly associated with the Detroit office, is now located at the Atlanta, Ga., branch. HENRY HOFFMAN, who was recently with the Cleveland branch office, is now manager of Wheelco in Columbus, Ohio.

FRANK J. O'LAUGHLIN has been elected president of the Commander Mfg. Co., Chicago, Ill. Mr. O'Laughlin, who was former director of sales and distributor relations, will continue to direct the sales activities of the company in addition to assuming his new management duties.

Frank J. O'Laughlin, president of Commander Mfg. Co.

GORDON F. WITT has been named field representative for the tubular products and cold-finished bar department at the Milwaukee plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill. He succeeds HARRY L. STURLA who has been transferred to the company's Chicago plant.

DEO M. BLOTT has been appointed technical specialist for Kaiser Aluminum & Chemical Corporation, Oakland, Calif. Mr. Blott will be attached to the rod, bar and wire product office at the company's general sales offices in Chicago, Ill.

JOSEPH W. TINAGLIA has been appointed to the newly created position of works manager of Franke Gear Works, Inc., Chicago, Ill. Mr. Tinaglia will have charge of manufacturing, engineering, tooling, and quality control.

STANLEY P. SAX has been appointed director of research in charge of process and product development for the American Buff Co., Chicago, Ill. He will also continue to direct sales operations in the Detroit area.

DREIS & KRUMP MANUFACTURING Co., Chicago, Ill. has announced the completion of Building No. 3 which adjoins the other buildings at 7400 S. Loomis Blvd. The new building has 40,000 square feet.

Michigan, Indiana and Wisconsin

MICROMATIC HONE CORPORATION, Detroit, Mich., announces the following executive promotions: DON S. CONNOR, executive vice-president, has also been named general manager, having been with the company for twenty-two years; WILLIAM H. HARRIS, JR., who joined the company in 1935, has been appointed vice-president and assistant general manager; R. G. ELLIS, who came to the firm in 1939, has been made chief engineer.

JOHN POLOMSKI has been appointed chief engineer of the Products Development Laboratory, Borg-Warner Corporation, Detroit, Mich. He has been with the company since 1934. In 1952, he joined the Products Development Laboratory where he supervised experimental work on automatic transmissions.

WILLIAM TAYLOR has been appointed assistant to the president of Detroit Bevel Gear Co., Detroit, Mich. Since 1945, Mr. Taylor has held the following key positions at the company—standards engineer, personnel and labor relations direc-

William Taylor, assistant to the president, Detroit Bevel Gear Co.

tor, production control manager, and purchasing agent. In his new capacity, Mr. Taylor is in charge of all Detroit bevel gear operations.

NATIONAL-STANDARD CO., Niles, Mich., has appointed four new executive officers: JAMES A. MOGLE, JR., vice-president, purchasing and reciprocal relations; THOMAS H. PEARCE, vice-president of engineering and operations; WILLIAM D. PEARCE, assistant vice-president of bead wire and hose wire sales; and GEORGE HUSSEY, JR., secretary and assistant to the president.

D. PIERSON SMITH has been elected vice-president of sales of the National Broach & Machine Co., Detroit, Mich. He was formerly assistant secretary and assistant treasurer. Mr. Smith will be responsible for the administration of sales policies and programs.

D. Pierson Smith, vice-president in charge of sales, National Broach & Machine Co.

CARBOLOY DEPARTMENT of General Electric Co., Detroit, Mich., announces the appointment of the McKee Tool & Supply Co., Lima, Ohio, as distributor for the Carboloy line of standard and special carbide metal cutting tools, as well as its diamond grinding-wheel dressers. McKee Tool & Supply Co. is located at 925 N. Jameson Ave., in Lima.

RICHARD BROTHERS DIVISION OF ALLIED PRODUCTS CORPORATION, Detroit, Mich., has announced completion of a new stamping plant at Eaton Rapids, Mich. W. J. JAMES has been put in charge of this plant. He will be assisted by M. L BOSIER.

ACAR BROACH CO., Detroit, Mich., announces the opening of a new plant to fabricate metal dies and molds for shaping plastic parts. The new organization is incorporated under the name of Acar Die & Mold Engineering Co., and is located in Roseville, Mich.

LARRY DARNELL has been made sales manager of the U. S. Broach Co., Detroit, Mich. Mr. Darnell has a diversified background in tool and production engineering, as well as modern broach engineering and manufacture.

Larry Darnell, newly appointed sales manager of U.S. Broach Co.

LEE F. DESMOND has been appointed assistant to the president of the Dodge Division, Chrysler Corporation, Detroit, Mich. BYRON J. NICHOLS has been made general sales manager in charge of all field operations.

CLARK L. BURGET, JR., has been appointed by the Barnes Drill Co., Rockford, Ill., as sales engineer in the Detroit office, 3419 S. Telegraph Road, Dearborn, Mich.

ROY M. NELSON has been appointed Detroit sales representative for the Miles Machinery Co., Saginaw, Mich. His offices are at 1538 Henrietta Ave., Birmingham, Mich.

J. LEE HACKETT, Detroit, Mich., has been appointed distributor for automatic lathes by Hydra-Feed Machine Tool Corporation, Ferndale, Mich.

MASTER SPLINE CO., Detroit, Mich., has purchased the machinery and special equipment inventory of Amco Gage Co., Detroit, Mich., and has moved into its plant located at 19760 W. Eight Mile Road, Detroit 19, Mich. The company's name has been changed to Master Spline Tool & Gage Co.

HARRY T. BURKE has been made chief engineer of the Hastings Division, Hastings, Mich., for the E. W. Bliss Co., Canton, Ohio. Prior to this, he had been assistant to the chief engineer. He joined the company in 1935.

Harry T. Burke who was made chief engineer of the Hastings Division, E. W. Bliss Co.

LEWIS W. BENTLEY has been named manager of the Detroit, Mich., office of Industrial Crane & Hoist Corporation, Chicago, Ill.

ATKINS SAW DIVISION, Borg-Warner Corporation, Indianapolis, Ind., announces the following promotions: JAMES E. BUTLER has been made eastern division manager; W. H. BRACE, northwest industrial division manager; W. M. BARBER, industrial sales representative in northern Oregon; JOHN G. DEUTSCH, western industrial division manager; and JAMES E. GOOD, central industrial division manager.

JOHN J. MCKEOWN has been made manager of the work order department of the Milwaukee, Wis., plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill. Mr. McKeown joined the company in 1937.

WILLIAM L. SHANK has been appointed works manager of Special Machinery Division, Kearney & Trecker Corporation, Milwaukee, Wis.

Missouri

AMERIGEAR-ZURN, INC., Erie, Pa., who markets the flexible couplings and allied power transmission products made by the American Flexible Coupling Co. of that city, has appointed Medor, Inc., St. Louis, Mo., sales representative. WILLIAM I. PIXLEY and EDWARD B. SEE have been named engineering sales representatives by the Medor firm and will cover the territory that includes the southern part of Illinois, eastern part of Missouri, and southwestern tip of Kentucky.

For more information on products advertised, use Inquiry Card, page 253

FULTON IRON WORKS, St. Louis, Mo., has announced the purchase of the Lehmann Boring Tool Division of the Novo Engine Co., St. Louis, Mo. The new division of Fulton will continue to purchase all types of boring tools, bars, blocks, and cutters, both standard and special. Key management personnel will continue with the firm. T. J. SLEETER is chief engineer and RUSSELL L. COLE is sales manager.

EMERSON ELECTRIC MFG. CO., St. Louis, Mo., announces the election of the following officers: EDWARD L. O'NEILL, vice-president and general sales manager; R. E. OTTO, vice-president of motors; GILBERT F. CRAIG, assistant vice-president of industrial relations; and WILLIAM L. DAVIS, JR., assistant vice-president of engineering.

J. N. ROGERS has been assigned as district salesman of the St. Louis, Mo., office of the Tubular Products Division of the Babcock & Wilcox Co., Beaver Falls, Pa. He will make his headquarters in the Continental Bldg., 3615 Olive St., St. Louis, Mo.

ARTHUR W. GADD has been appointed manufacturers' representative in Missouri for Horton Chuck Division of the E. Horton & Son Co., Windsor Locks, Conn.

New England

CAPEWELL MFG. CO., Hartford, Conn., announces the following recent revisions in the Chicago and northeastern sales territory: JOHN DWYER will represent the line of pipe and tubing tools in New England and in New York State, excluding New York City; LAWRENCE MCCLURE will represent the line of hand power and band-saw blades, ground flat tool steel, and hammers in New England and in eastern New York State, excluding New York City; WILLIAM O'MALLEY will represent all lines in metropolitan New York; PAUL B. MOCHEL will represent the company's entire line in eastern Pennsylvania, Maryland, and southern New Jersey.

FARREL-BIRMINGHAM CO., INC., Ansonia, Conn., announces the following executive appointment: FRANKLIN FARREL, III, was elected president, succeeding FRANKLIN R. HOADLEY, who has retired; also, three new vice-presidents have been appointed—EDWARD S. COE, JR., manager of the two Connecticut plants and assistant to the president, ROBERT M. HONEGGER, general manager of the company's Buffalo plant, and JOSEPH LEMAY, who will continue as treasurer; JULIUS G. DAY, JR., has been made secretary and general counsel.

THE HARTFORD SPECIAL MACHINERY CO., Hartford, Conn., has purchased the complete line of Rockwell hydraulic drill units from Rockwell Mfg. Co., Pittsburg, Pa. The units will be produced by the company's Steel Machine Tool Division in its Simsbury, Conn., plant. Transfer of equipment, tools, and inventory to Simsbury from Rockwell's Pittsburgh plant has been effected. Key sales, engineering, and production personnel have been retained by the company and will relocate in the Hartford area.

ROWBOTTOM MACHINE CO., Waterbury, Conn., announces the following executive appointments: ARCHER ROWBOTTOM, chairman of the board; GEORGE ROWBOTTOM, 2nd, president, and EDWARD RAHN, executive vice-president.

ALLAN L. BURTON has been appointed research director of Veeder-Root Incorporated, Hartford, Conn. Market and product research will be combined under Mr. Burton's direction.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., has acquired the ARTHUR C. HARVEY CO., Boston, Mass., steel and aluminum distributor. Ryerson will consolidate its greater Boston operations at the Harvey plant. ROBERT T. HARVEY has been made manager of the newly created aluminum department.

GEORGE E. FARREN has been appointed field engineer and assigned to the Hartford, Conn. district office by the Norton Co., Worcester, Mass.

New York and New Jersey

J. B. SEWELL has been elected a vice-president of the Garlock Packing Co., Palmyra, N. Y. He started with the Garlock Packing Co. of Canada, Ltd., in 1935 as a sales representative in the Montreal area and was later elected vice-president of that company. In 1954, Mr. Sewell was transferred to the United States and appointed general sales manager of the parent company with over-all direction of sales, both in Canada and the United States. As vice-president, he will continue directing sales operations of the organization.

J. B. Sewell, vice-president of the Garlock Packing Co.

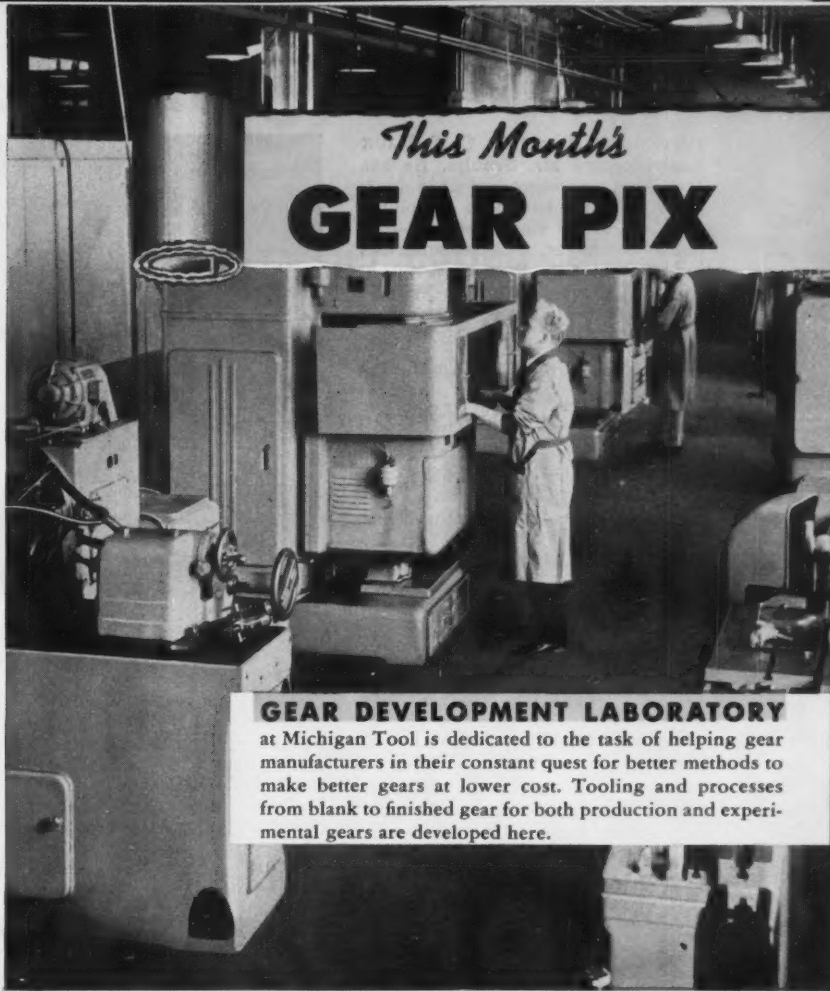
EUGENE EASTERLY has been appointed vice-president of distribution of Linde Air Products Co., a Division of Union Carbide and Carbon Corporation, New York City. Mr. Easterly joined the company as a development engineer at the Buffalo laboratory in 1931. He moved to the New York office in 1941 and was appointed distribution manager in 1949. E. G. HICKLING has been made vice-president of operations for the company. He began his career with Linde in 1927 as an engineer at the company's laboratory in Buffalo.

VINCENT E. LYSAGHT has been made general sales manager of the American Chain & Cable Co., Inc., New York City. He was formerly divisional manager of the Helicoid, Campbell Machine, and Wilson Divisions of the company. His headquarters will be at 230 Park Ave., New York City.

Vincent E. Lysaght, general sales manager of the American Chain & Cable Co., Inc.

VANADIUM CORPORATION OF AMERICA, New York City, announces the following executive changes: HOWARD C. PARKMAN has been appointed assistant vice-president of operations with headquarters at the Niagara Falls plant. Previously plant manager at Niagara Falls, Mr. Parkman has been associated with the company since 1941. C. A. J. SCHULTE has succeeded Mr. Parkman as plant manager at Niagara Falls. Previously superintendent of furnace operations, Mr. Schulte has been with

HELICAL, TAPER, OR STRAIGHT involute splines like these are rolled in a few seconds. ROTO-FLO spline roller forms accurate splines up to thirty times faster at lower cost. (Bulletin RF-54.)



GEAR DEVELOPMENT LABORATORY at Michigan Tool is dedicated to the task of helping gear manufacturers in their constant quest for better methods to make better gears at lower cost. Tooling and processes from blank to finished gear for both production and experimental gears are developed here.

MACHINE TOOL SHOW
AT CHICAGO—SEPT. 6 THRU 17

HOBBER "THINKS" FOR ITSELF, keeps records on production, shifts the hob, adjusts hob-gear center distance for correct gear size, shuts down for helix errors, loads and unloads—all automatically. This new, completely automated 1445 Ultra-Speed gear hobber hydraulically crossfeeds the hob at the helix angle of the gear. (Bulletin LH-54.)

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.

the company since 1939. C. W. MAUK has succeeded Mr. Schulte. He has been with the company since 1941. R. T. BAILEY has been appointed assistant to the vice-president—production manager, with headquarters in New York City. He was previously assistant plant manager at Niagara Falls. Mr. Bailey has been associated with the company since 1940.

AMERICAN PRODUCTS CO., Staten Island, N. Y., announces the purchase of the ROGER ALAN MFG. CO. The company will manufacture and distribute commercial faucets and positive displacement pumps, and will concentrate on the design, development, and manufacturing of precision machine parts for the electronics and aircraft industries.

FLOYD V. SNODGRASS has been elected vice-president in charge of production of the Walworth Co., New York City. Mr. Snodgrass was formerly associated with the Pacific Car & Foundry Co., where he was works manager and assistant to the vice-president, at the Seattle, Wash., plant.

JAMES M. MOTLEY & CO., INC., New York City, have been appointed world-wide export distributors for engine and gap lathes manufactured by the Nebel Machine Tool Co., Cincinnati, Ohio.

DR. JOHN A. LORITSCH has been made manager of the General Electric Chemical Materials Department at the Alkyd Products Plant, Schenectady, N. Y. He joined the company in 1940 as a research chemist.

EDWIN R. SMITH, JR. has been elected executive vice-president and general manager of the Seneca Falls Machine Co., Seneca Falls, N. Y., manufacturers of Lo-swing lathes and automation equipment.

Edwin R. Smith, Jr., executive vice-president and general manager of Seneca Falls Machine Co.

(Left) Charles J. Stilwell, chairman of the board; (right) Walter K. Bailey, president of Warner & Swasey Co.

EDWARD H. ELLIOTT has been appointed representative for the Hygrade Metal Finishing Division in the Philadelphia area for the U. S. Hoffman Machinery Corporation, New York City. Mr. Elliott will serve the territory which will include eastern Pennsylvania, Delaware, and the southern area of New Jersey.

BLAW-KNOX CO., Pittsburgh, Pa., announces that the company's Process Equipment Department, formerly at Pittsburgh, is being integrated into an enlarged and modernized Buflovak Equipment Division at Buffalo, N. Y. This consolidation constitutes one of the first phases of a $15,000,000 modernization program.

F. J. STOKES MACHINE CO., INC., Philadelphia, Pa., has opened a New York district sales office at 26 E. 1st St., Mount Vernon, N. Y., and a branch office at 2165 Morris Ave., Union, N. J. RALPH H. STALBAUM, who has been serving the northern New Jersey territory from the New York office, will be in charge of the Union office.

JOHN S. DAVEY has been promoted to vice-president of Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y. Formerly assistant general sales manager, Mr. Davey has been associated with the company for twenty-five years.

Ohio

CHARLES J. STILWELL, who has been president for the past sixteen years of Warner & Swasey Co., Cleveland, Ohio, has been elected chairman of the board. He started as a special apprentice and served in all departments of manufacturing and sales, advancing successively to the positions of New York district manager, general sales manager, vice-president and director, and president. WALTER K. BAILEY has been elected president, succeeding Mr. Stilwell. He, too, joined the company as a special apprentice in 1919, became sales representative in the Chicago area, advanced through various positions in the sales department to sales manager in 1939, and vice-president in charge of sales in 1942. In 1951, he was elected vice-president of manufacturing.

AUTOMATIC STEEL PRODUCTS, INC., Canton, Ohio, announces the sale of its wholly owned subsidiary, CLEVELAND TAPPING MACHINE CO., also of Canton, to the H. P. TOWNSEND MFG. CO. of Hartford, Conn. No change in name is contemplated,

SKF INDUSTRIES, INC., Philadelphia, Pa., has acquired the controlling interest in Tyson Bearing Corporation, Massillon, Ohio. Operations at Massillon will continue without interruption under the management headed by HARRY I. LEWIS, president.

CLEVELAND CRANE & ENGINEERING CO., Wickliffe, Ohio, has begun excavation for an engineering building adjoining its present plant that will cost about $300,000. This is the third building in an expansion program started in January of this year.

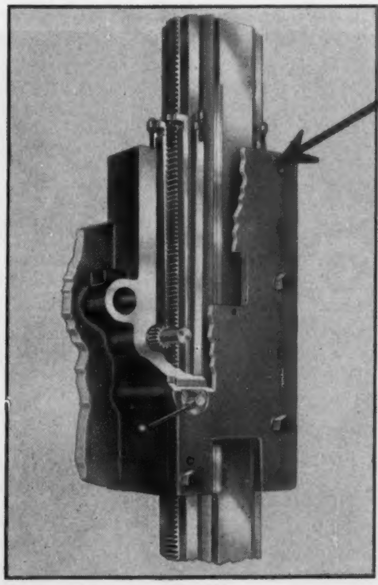
BEN H. WARD has been promoted to manager of the Factory Division of the Lees-Bradner Co., Cleveland, Ohio. In addition to his new position, he will continue in his capacity as assistant treasurer.

GORDON A. SOMMER, formerly chief engineer of the Clearing Machine Corporation plant in Hamilton, Ohio, has been made head of the department for research.
(This section continued on page 259)

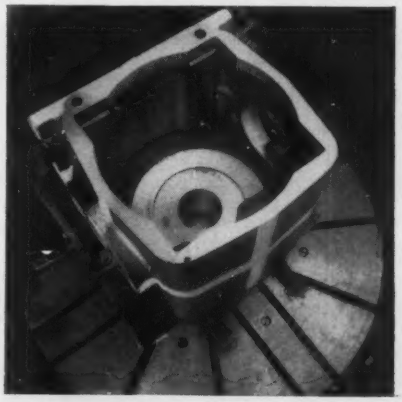
At The Oilgear Company — KING precision assures *exceptional accuracy* in taper boring

For the Oilgear Company, Milwaukee, Wisc., the 62″ King® Vertical Boring & Turning Machine, shown at right, precision-machines castings for high pressure pumps. An example of the extreme accuracy obtained is the taper boring, in Class 50 gray iron, of 7″ diameter x 8″ deep holes to .005″ per inch of taper, while holding .001″ tolerance on the diameter for the entire depth of the hole. A finish better than 125 micro-inches is maintained. On other boring, facing, and turning work—on parts for cases, end covers, rotors, etc., for 60, 100, and 150 hp. Oilgear Pumps—similar dimensional precision and fine finish are obtained.

Here again is on-the-job *proof* of how King superior design, massive proportions, and extra-rigid construction provide the ability to cut costs and improve quality on the complete range of boring, facing, and turning work. King machines are made in ten sizes, from 30″ to 144″. For full information see your King Distributor, or write us.



Cut-away drawing of rail head, at left, illustrates how extra rigidity is built into King machines, assuring an unvarying accuracy that makes possible fine-dimension tapering and other operations such as those described by the Oilgear Company . . . Drawing shows construction of support and guiding of the ram in its relation to the swivel. There are eight bearing surfaces, two on each side of the rectangular ram. Adjustment to these surfaces is obtained with the use of four gibs, two on the front and two on the side. To overcome any spreading of the guiding surfaces of the ram, a plate the full length of the swivel is tongued, as shown. Accurate guiding surfaces are thus maintained at all times.



Close-up view of the work being machined above. Note the fine finish (better than 125 micro-inches) obtained on the facing work and in the tapered bore, as a result of King built-in precision features.

Visit us at the Machine Tool Show—Chicago, Sept. 6-17—Booth 1121

KING

AMERICAN STEEL FOUNDRIES • KING MACHINE TOOL DIVISION
1150 Tennessee Avenue . . . Cincinnati 29, Ohio

VERTICAL BORING & TURNING MACHINES

For more information on products advertised, use Inquiry Card, page 253

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On products mentioned in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

ROLLING-MILL BEARINGS—Torrington Co., South Bend, Ind. Manual giving check list of nineteen steps for proper maintenance of rolling-mill bearings and information on installation and use. Procedures are outlined for increasing bearing service and life. Can be obtained on company letterhead request direct to the above address. . . . .

NICKEL-ALLOY CAST IRON—International Nickel Co., Inc. New York City. Newly revised bulletin A-71, containing 64 pages, 96 figures, 15 tables and charts which feature applications of "Ni-Resist," corrosion-resistant nickel-alloy cast iron, in nine specific industries as well as in general industrial uses. Mechanical and physical properties offered by eight types of "Ni-Resist" are tabulated. Problem data sheets are included for submitting heat, corrosion, or controlled expansion problems to development and research staff. 1

INDUCTION HEATING EQUIPMENT—Westinghouse Electric Corporation, Pittsburgh, Pa. 12-page booklet describing induction heating equipment and giving typical applications for forging, hardening, annealing and metal joining. In addition to complete control and work facilities, a description of the work-station housing for all components such as output transformers, capacitors, plumbing for quench and cooling water, contactors, and timers is presented. 2

LATHE CHUCKS—Horton Chuck Division of the E. Horton & Son Co., Windsor Locks, Conn. Catalogue W-200, featuring Tru-Set and Windsor line of chucks with visual selection of the desired chuck to make it possible to easily locate a model and model number, type and number of jaws, chuck size, spindle nose, and net price. Semi-finish and rough adaptor drawings, dimensions and drawings for "D1," "L," and straight recessed spindle-nose mountings are shown for every chuck listed in the catalogue. 3

DUCTILE IRON—International Nickel Co., Inc., New York City. Bulletin D1-25, describing the newly developed cast metal, which combines the process advantages of cast iron, such as castability and machinability, with the strength, toughness, wear resistance, and ductility of steel. The booklet, illustrated with more than forty photos, includes case histories, specification tables for the seven main types of ductile iron, and charts comparing mechanical properties. 4

ELECTROLYTIC GRINDING—Anocut Engineering Co., Chicago, Ill. 12-page manual explaining how electronic control makes possible automatic electrolytic grinding of cemented carbide tools and other hard-to-grind materials. The actual grinding process is described in theory and in practical application. The booklet covers the company's line of equipment including the electric supply unit, the electrolyte, and electrodes. 5

APPLICATION OF IRON PHOSPHATE COATINGS TO STEEL—Oakite Products, Inc., New York City. 12-page pamphlet describing how to apply iron phosphate coatings to steel, in preparation for painting, by using Oakite CrysCoat Process. Booklet points out that the selection of iron or zinc phosphate treatments depends upon the purpose for which the article is intended. Included are diagrams, drawings, and photographs. 6

NICKEL-COPPER LOW-ALLOY HIGH-STRENGTH STEELS — International Nickel Co., Inc., New York City. A 48-page booklet which illustrates the wide application of steels in transportation, bridge construction, mining, agriculture, marine equipment, and other fields. Working methods, mechanical properties, compositions, and availability of seven steels of this class are given. Numerous tables and charts and more than one hundred illustrations are included. . . 7

TAP MARKING SYSTEM—Besly-Welles Corporation, Beloit, Wis. Tap catalogue, including a simplified guide to the company's tap marking system and featuring a complete line of standard and special taps. A graph shows how the tap marking system establishes various classes of fits in sizes from 0 to 80 through 1 1/2-inch diameters. A conversion table for changing old designations to the new marking system is also given. 8

PUSH-BUTTON LATHE—Hardinge Bros., Inc., Elmira, N. Y. Fully illustrated 24-page bulletin covering all cost cutting, high-speed, and precision operating features of the Model HLV lathe, including gear-box and lead-screw for threading only, independent variable-feed for carriage and cross-slide, and the easy reading black and white feed dials. Complete specifications and tool accessories for the lathe are given. 9

V-DRIVE SELECTIONS—Fort Worth Steel & Machinery Co., Fort Worth, Tex. Guide 50-B, containing simplified formulas for standard quarter-turn and V-flat drives augmented by tables of drives in all belt sections which have been compiled for quick selection of drives of required ratio and speed. Using new horsepower rating and improved rating techniques, this bulletin also contains information on other types of V-belt drives. 10

FIRST CLASS
Permit No. 53
(Sec. 34.9, P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY—

MACHINERY
93 WORTH STREET
NEW YORK 13, N. Y.

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CARTRIDGE AIR VALVES—Carter Controls, Inc., Lansing, Ill. Bulletin V-150, featuring complete details on sizes, services, construction, and parts of cartridge air valves. Diagrams of the three basic types are shown. These are solenoid-operated, palm poppet-operated, and lever poppet-operated. Also included are complete details on mounting brackets. **11**

GRINDING AND MILLING POWER QUILLS AND ACCESSORIES—Precise Products Corporation, Racine, Wis. Catalogue FGH-2 containing twenty pages of data on milling and grinding equipment for small precision parts. Included is a description of the new Precise Super 60 power quill with a 1/2 H.P. motor, and capable of operating at speeds as high as 45,000 R.P.M. **12**

TOTALLY PROTECTED ALTERNATING-CURRENT MOTORS—Reliance Electric & Engineering Co., Cleveland, Ohio. 12-page illustrated information booklet entitled "Check the Facts" pointing out 100 characteristic facts of the company's new line of alternating-current motors and containing a breakdown of information pertaining to protected and enclosed motors. **13**

UNIVERSAL JOINTS—Joint Division of the Gear Grinding Machine Co., Detroit, Mich. 12-page catalogue covering applications, models, and sizes for proper joint selection. Constant Velocity, the principle on which the joints are designed, is described and illustrated. **14**

GAGE-BLOCKS AND ACCESSORIES—Fonda Gage Corporation, Dept. M-22, Stamford, Conn. 28-page catalogue entitled "Precision in Millionths," describing product line of "Ultra-Finish" rectangular and Hoke type gage-blocks. A technical data section is given which includes information on care and handling of gage-blocks and citing typical applications. **15**

SERVO TORQUE UNITS—John Oster Mfg. Co., Racine, Wis. Technical data sheet containing typical units in the Oster line of synchros, servo torque units, alternating-current drive motors and servo motors, and direct-current motors. Also included are tachometer generators, actuators, and motor-driven blowers and fan assemblies. **16**

UNDERCUT GAGE—Mueller Laboratory, Monrovia, Calif. Bulletin citing advantages of undercut gage having a measurement range from 0.187 to 2.250 inches. The gage can be used for measuring "O" ring grooves, tapers, recesses, inside spherical radii and out-of-round, and with a change of measuring tips can measure snap-ring grooves and bores. **17**

GAP PRESSES—Minster Machine Co., Minster, Ohio. 12-page booklet giving latest information on the Series GI single-point steel-frame Gap Press which ranges from 75 to 200 tons. Standard features and extra equipment are listed. Photographs illustrate this press in action. Specifications are also given. . . **18**

ADJUSTABLE BORING AND REAMING TOOLS—Madison Mfg. Co., Muskegon, Mich. Catalog 53 featuring concise descriptions of the company's line of rough-boring and reaming tools, grinding fixture, and grinding arbors. A recent development is a combination rough-boring and finishing tool called the Boreamer. **19**

PUNCHING PRESSES—Ferracute Machine Co., Bridgeton, N. J. Catalogue P-100 containing 4 pages of information on standard throat non-adjustable bed presses, and including specifications and illustrations. Data is given on advantages of friction clutch and positive clutch. Details are given on features of the models. **20**

ELECTRONIC GAGING EQUIPMENT—Cleveland Instrument Co., Cleveland, Ohio. Bulletin 542 comprises 12 pages featuring electronic gaging equipment for use in dimensional inspection, control applications in gage rooms, tool rooms, and production departments. Special features and typical applications are included. **21**

VERTICAL MILLING MACHINE—Elgin Tool Works, Inc., Chicago, Ill. Publication describing the company's precision vertical milling machine. Consisting of four pages, the booklet provides specifications and illustrations of the construction features. Standard equipment is listed separately. . . . **22**

DISC-GRINDING MACHINES—Besley-Welles Corporation, Beloit, Wis. 16-page catalogue containing application and construction information on the company's double horizontal disc grinders in sizes ranging from 3 to 50 H.P., which use disc wheels ranging from 12 to 72 inches in diameter. **23**

DIRECT-CURRENT MOTORS—Reliance Electric and Engineering Co., Cleveland, Ohio. Bulletin C-2002 describing direct-current motors with dynamic response. Information is given on speed ranges, acceleration rates, enclosures, dimensions, and selection data. Photographs, diagrams, charts, and sketches are included. **24**

REVOLVING UNIT HEATERS—L. J. Wing Mfg. Co., Linden, N. J. 16-page catalogue explaining the design and construction of revolving unit heaters and giving engineering data including mounting heights and coverage, dimensions and weights, installation planning and thermostatic control. **25**

MULTI-PURPOSE WORK-HOLDERS—Lassy Tool Co., Plainville, Conn. Leaflet describing features of work-holders, including interchangeable inserts, rugged and open design, positive work stops, cam lock, and swing clamps. Also included are many set-ups of Model P-2 and standard accessories. **26**

HYDRAULIC SURFACE CYLINDERS—Thompson Grinder Co., Springfield, Ohio. Catalogue CX 54, describing and illustrating the Type CX surface grinder. Construction details are given with specifications and diagrams of controls. Auxiliary equipment is listed which is optional at extra cost. **27**

AUTOMATIC NUT FORMERS—Waterbury Farrel Foundry and Machine Co., Waterbury, Conn. Bulletin 930-A-2 con-

Product Information Service

Use postage-free Business Reply Card below for further information concerning New Catalogues described in this issue and products mentioned in the editorial pages or advertisements.

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taining eight pages of information on the company's newly designed line of automatic nut formers and giving features, applications, specifications, and illustrations. 28

ALTERNATING-CURRENT MOTORS—General Electric Co., Schenectady, N. Y. Publication GEC-1026, a 28-page catalogue containing buying information on alternating-current motors. Included are general- and definite-purpose fractional horsepower motors and gear motors. 29

VARIABLE SPEED LATHE—Logan Engineering Co., Chicago, Ill. Bulletin 14-L containing detailed information on the features of Model "6560." Specifications and descriptions are given of ball-bearing headstock and spindle, precision carriage and bed, and variable speed drive. 30

VIBRATION ISOLATION EQUIPMENT—Barry Controls, Inc., Watertown, Mass. Bulletin 546 describing benefits gained from mounting machinery on mobile mounts and giving a summary of the types of Barrymounts which have been engineered for applications on various machines. .31

STEEL PRESS BRAKES AND DIES—Service Machine Co., Inc., Elizabeth, N. J. 8-page two-color folder containing specifications and illustrations on Semco steel press brakes and forged steel press brake dies. Standard brake dies up to 12 feet may be ordered from folder. . . .32

MOTOR CONTROL SELECTION—General Electric Co., Schenectady, N. Y. Publication GEC-1260A, a 68-page catalogue on general-purpose control devices, with a section correlating, by horsepower, components for each type of motor control application. 33

OPTICAL MEASURING AND INSPECTION EQUIPMENT—George Scherr Optical Tools, Inc., New York City. 70-page booklet giving details and specifications on the more essential and commonly used optical precision measuring and inspection equipment. 34

CARBIDE TOOLS AND TIPS—Valenite Metals Corporation, Royal Oak, Mich. 33-page catalogue covering carbide tips, tools, throw-away blanks and holders and featuring a new form of carbide equivalent charts to aid in grade selection and application. 35

PLASTIC SHELF SUPPORTS—Shakeproof Division, Illinois Tool Works, Elgin, Ill. Catalogue showing complete line of "Plasti-Supports" for refrigerators, cabinets, and freezers, and containing photographs, diagrams, and specifications. 36

PRECISION HAND TOOL—Nord International Corporation, Orange, N. J. Folder descriptive of the "Di-Profiler" hand tool and illustrating different applications including scraping, honing, milling, filing, polishing, sawing, and grinding. 37

PRECISION TOOLROOM VISE—Producto Machine Co., Bridgeport, Conn. Bulletin giving information on a precision toolroom vise which can be clamped to any machine, and can be used on jig borers, surface grinders, drill presses, and tappers. 38

DRILLING MACHINE—Edlund Machinery Co., Cortland, N. Y. Bulletin 160, on the Model 1F sensitive drilling machine. Exclusive features, design highlights and specifications are covered. The machine is available in pedestal and bench type model. 39

SWISS MACHINE TOOLS—Carl Hirschmann Co., Inc., Manhasset, N. Y. 8-page folder descriptive of Swiss precision machine tools and including information on Hauser jig borers, Tornos Swiss type automatic screw machine, Nassovia die-sinker and others. 40

NON-ROTATING AIR CYLINDERS—Miller Fluid Power Co., Melrose Park, Ill. Bulletin A-105K comprising eight pages of information on design, construction, engineering and mounting, and dimensional data on Miller 200 pounds per square inch heavy-duty air cylinders. 41

LUBRICATION CHART—E. F. Houghton & Co., Philadelphia, Pa. Wall chart in two colors showing such applications as hydraulic systems, spindles, air compressors, reduction gears, electric motors, oven conveyors, and other general uses. 42

STEEL FORGING—National Forge & Ordnance Co., Irvine, Warren County, Pa. Leaflet containing a brief but complete description of the operation of a steel forging business integrated from electric steel making to finished machining. 43

INSERT BITS AND HOLDERS—Continental Screw Co., New Bedford, Mass. 14-page booklet giving diagrams, illustrations, and production data on insert bits and holders, and including results of tests made in several operations in plant. 44

MILLING MACHINES—Sundstrand Machine Tool Co., Rockford, Ill. Circular giving data on two heavy-duty models for die-block milling. Sequence of operations for shanking die-blocks is described and illustrated. 45

PUNCHING PRESSES—Ferracute Machine Co., Bridgeton, N. J. Catalogue P-300, containing 4 pages of information on deep-throated punching presses, and including illustrations. Advantages of friction clutch and positive clutch are outlined. 46

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TRIMMING DIE AND PRESS EQUIPMENT—Steel Products Engineering Co., Springfield, Ohio. 12-page catalogue describing the operation of the company's trimming die and trimming press, and pointing out the applications of this equipment in the metal-working industry. **47**

GEAR SELECTION—Foote Brothers Gear and Machine Corporation, Chicago, Ill. 30-page manual illustrating and listing complete line of gear selection and showing efficient, space-saving gear arrangements. A section is devoted to gear maintenance tips. **48**

DIE-CAST FASTENERS—Gries Reproducer Corporation, New Rochelle, N. Y. Bulletin containing illustrations of each type of fastener, diagrams with complete specifications, and lists of stock sizes to facilitate selection of the right size and type of fastener. **49**

DIE-CASTING MACHINE—Cleveland Automatic Machine Co., Cincinnati, Ohio. Bulletin describing Model 200 die-casting machine and giving features and general specifications. **50**

HEATING AND SWAGING MECHANIZED—Fenn Mfg. Co., Newington, Conn. 4-page leaflet describing how full automation in loading, heating, feeding, and swaging increases production and reduces need for operator attention. Illustrations show how one operator can tend several machines. **51**

TOOL BITS—The DoAll Co., Des Plaines, Ill. Leaflet giving brief data on molybdenum, tungsten and cobalt high-speed steel bits. Suggestions are given for proper grinding and mounting of bits. **52**

VISES—Columbian Vise & Mfg. Co., Cleveland, Ohio. Catalogue containing specifications on machinists', die, chipping, metal-working, work shop, home shop, woodworkers', and woodcraft vises and listing vise accessories and replacements parts. **53**

TAPS AND DIES—Winter Brothers, Inc., Rochester, Mich. Catalogue 22, consisting of 32 pages featuring balanced action taps and dies; also describing general-purpose taps, taps for special applications, and revision of tap standards. . .**54**

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HYDRAULIC PRESSES AND DIE-CASTING MACHINES—Lake Erie Engineering Corporation, Buffalo, N. Y. Catalogue containing comprehensive selection chart relating the various types of presses to their most suitable production uses. . .**55**

PLASTICS TOOLING—Shell Chemical Corporation, New York City, 14-page manual giving information on the uses and applications of Epon 828 in tooling. Also included are specifications, special properties, and curing agents of this resin. **56**

PUNCHES AND PIERCING ACCESSORIES—Pivot Punch & Die Corporation, North Tonawanda, N. Y. 21-page catalogue indicating specific uses and sizes available in the company's punch and piercing accessories in high-speed steel. **57**

POWER PRESS—Sales Service Machine Tool Co., St. Paul, Minn. Bulletin describing a 45-ton press and tabulating specifications which include built-in steel tie-rods and extra-heavy 4-inch crankshaft at main bearings. **58**

VERTICAL MOTORS—U. S. Electrical Motors, Inc., Los Angeles, Calif. Bulletin describing and illustrating vertical solid-shaft motors in ratings from 1/4 to 400 H.P. in grease and oil lubricated types. **59**

STANDARD JIG AND FIXTURE PARTS—West Point Mfg. Co., Detroit, Mich. Catalogue describing line of standard jig and fixture parts available from the company **60**

PRECISION DOWEL PINS—Danly Machine Specialties, Inc., Chicago, Ill. 4-page folder listing the entire line of precision dowel pins—both standard size and oversize. **61**

ELECTRONIC MACHINE TOOL—Elox Corporation, Clawson, Mich. 8-page catalogue describing the Elox "M-500," an electronic machine tool for precision drilling, die-sinking, broaching, and reaming. **62**

ALUMINUM EXTRUSION PRESSES—Watson-Stillman Co., Division of H. K. Porter Co., Inc., Roselle, N. J. Bulletin 340B featuring the extrusion process, presses, and stretchers. **63**

MULTIPLE COIL CRADLE—U. S. Tool Co., Inc., Ampere, N. J. Leaflet explaining how Multi-Roll Cradle unwinds stock from coils under complete control. Design features and specifications are included. **64**

FORGED TOOLS—Modern Tools Division, Nelco Tool Co., Inc., Berlin, Conn. Folder describing in detail forged high-speed steel tools. Gives drawings and specifications of standard tools. **65**

BROACHES—American Broach & Machine Co., Ann Arbor, Mich. Revised Catalogue 450, containing 33 pages descriptive of broach design, broaching machines, and applications. **66**

PRECIOUS METAL PLATING—Harper Leader, Inc.. Waterbury, Conn. Booklet describing properties and uses of precious metal electrodeposits. Tables of technical data are included. **67**

SHIMS—Laminated Shim Co., Inc., Glenbrook, Conn. Catalogue describing laminum shims and the products in which they are used. **68**

For more information on products advertised, use Inquiry Card, page 253

Joseph A. Geuss, chief engineer of Clearing Machine Corporation

JOSEPH A. GEUSS has been appointed chief engineer of the Clearing plant in Hamilton, Ohio, for the Clearing Machine Corporation, Division of U. S. Industries, Inc., Chicago, Ill. He has been associated with the company for seventeen years and his last position was engineering supervisor at the Chicago plant. Mr. Geuss will be responsible for engineering of inclinable, horning, and other Clearing press lines manufactured at the Ohio plant.

CARL A. EVERSMAN has been made manager of Mullins Mfg. Corporation, Salem, Ohio. Mr. Eversman will direct production operations in the company's two Salem plants.

MIDWEST PRECISION CASTINGS CO., Cleveland, Ohio, has moved from 2790 Grand Avenue into larger quarters at 10703-09 Quincy Avenue.

RICHARD V. ABBOTT has been appointed sales representative in Dayton, Ohio, for Columbia Steel & Shafting Co., Pittsburgh 30, Pa.

A. M. THOMAS has been appointed director of sales for the Heller Bros. Co., Newcomerstown, Ohio. He succeeds Lawrence M. Rich.

MILTON HARMON has been appointed Eastern representative of Cast-Master, Inc., Cleveland, Ohio.

Pennsylvania

FIRTH STERLING, INC., Pittsburgh, Pa., announces the following new appointments: W. B. WITHERS has been appointed carbide service engineer in the Cincinnati-Dayton, Ohio area; J. B. WILSON has been appointed sales representative in Detroit, Mich.; J. D. DOHERTY has been appointed sales representative in Chicago, Ill., CARLISLE R. HENRY has been made carbide service engineer in this same district with headquarters in Indianapolis, and J. J. BARRY has been made sales representative in Pittsburgh, Pa.

F. J. STOKES MACHINE CO., INC., Philadelphia, Pa., announces the following new appointments: J. GORDON SEITER has been named manager of the High Vacuum Division; G. JEWETT CRITES, has been made manager of the Vacuum Processing Division; JOHN F. MAGUIRE JR., has joined the headquarters staff as manager of drum dryer and flaker sales; and KENDRICK C. TAYLOR has been placed in charge of vacuum furnace sales.

C. SPENCE PURNELL has been named manager of the South Pacific district, Los Angeles, Calif., by the Westinghouse Electric Corporation, Pittsburgh, Pa. Mr. Purnell succeeds STANLEY M. JOHNS. Mr. Johns has been appointed sales manager of the hydraulic drives department of the Westinghouse Gearing Division at Muncie, Ind.

HERBERT J. ARNOLD has been appointed supervisor of stainless, bar, wire, and billet sales for Crucible Steel Co. of America, Pittsburgh, Pa. FRANK J. COATES has been made supervisor of stainless steel sales in the Cleveland branch, the position previously held by Mr. Arnold.

ALLOY PRECISION CASTINGS CO., Cleveland, Ohio, has appointed Hopper & Son as exclusive sales representative for the company in the western Pennsylvania, northern West Virginia and southeastern Ohio territory. Hopper & Son, located at 510 Salem Drive, Pittsburgh, Pa., is headed by PETER T. HOPPER and THOMAS HOPPER.

ARTHUR G. TICHENOR has been named manager of manufacturing of the Industrial Products Division, Westinghouse Electric Corporation, Pittsburgh, Pa. In his new position, he will be responsible for all manufacturing activities.

AIR BRAKE DIVISION, Westinghouse Air Brake Co., Wilmerding, Pa., announces the formation of a new Special Products Group to expand that division's manufacturing and marketing activities. DEWITT L. SHELLY has been appointed manager of this new group.

CARBOLOY DEPARTMENT of General Electric Co., Detroit, Mich., has appointed Harris Hardware & Supply Co., Inc., Kingston, Pa., as carbide distributor. The office is located at 660 Market Street, Kingston.

EDWIN R. BRODEN has been elected executive vice-president of SKF Industries, Inc., Philadelphia, Pa. Mr. Broden was formerly executive vice-president and director of The Carborundum Company, Niagara Falls, N. Y.

FRED R. BROWN has been appointed district sales representative for McBeth Machinery Co., Pittsburgh, Pa. His territory will include the Akron, Canton, Youngstown and Salem areas.

HAROLD O. WARNOCK has been made chief plant engineer for Firth-Loach Metals, Inc., McKeesport, Pa. and JACK H. POWERS superintendent of X-ray and metallography.

WILLIAM D. CRADDOCK has been named head of stainless steel fabrication at Kaiser Metal Products, Inc., Bristol, Pa.

Coming Events

MAY 16-20—SIXTH NATIONAL MATERIALS HANDLING EXPOSITION at International Amphitheatre, Chicago, Ill. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MAY 31-JUNE 3—THIRD BASIC MATERIALS EXPOSITION to be held at Convention Hall, Philadelphia, Pa. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

JUNE 5-8—Annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Homestead, Hot Springs, Va.

JUNE 7-10—National spring meeting of the AMERICAN WELDING SOCIETY to be held at the Hotel Muehlebach, Kansas City, Mo. The Welding Show will be held at the Kansas City Auditorium. Further details can be obtained by writing to the Society, 33 W. 39th St., New York 18, N. Y.

JUNE 8-10—Third Annual Welding Show under the sponsorship of the AMERICAN WELDING SOCIETY to be held at the Municipal Auditorium, Kansas City, Mo. National secretary, Joseph G. Magrath, 33 W. 39th St., New York 18, N. Y.

SEPTEMBER 6-17—METALWORKING MACHINERY AND EQUIPMENT EXPOSITION to be held at the Coliseum, Chicago, Ill. Further information can be obtained from Chester L. Wells, general manager, 2689 East Overlook Road, Cleveland 6, Ohio.

SEPTEMBER 6-17—Machine Tool Show sponsored by the NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION to be held at the International Amphitheatre, Chicago, Ill. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

SEPTEMBER 6-17—PRODUCTION ENGINEERING SHOW, coinciding with the Machinery Tool Show, to be held at

the Navy Pier, Chicago, Ill. For further information, write to Clapp & Poliak, Inc 341 Madison Ave., New York 17, N. Y.

OCTOBER 23-26 — Semi-annual meeting, AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Edgewater Beach Hotel, Chicago, Ill.

NOVEMBER 14-18—Chicago Exposition of Power and Mechanical Engineering, under the auspices of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS, in conjunction with their Seventy-fifth Anniversary Meeting, to be held in the Chicago Coliseum, Chicago, Ill. Further information can be obtained from the International Exposition Co., 480 Lexington Ave., New York 17, N. Y.

Obituaries

Hannibal Choate Ford

HANNIBAL CHOATE FORD, founder of the Ford Instrument Co., New York City, died at his home on Long Island, N.Y., on March 12, at the age of seventy-eight years. He organized the Ford Instrument Co. in 1910. Mr. Ford was the inventor of the first mechanical brain for controlling gunfire.

Louis Pelletier

Louis Pelletier, who was a member of MACHINERY'S advertising staff for over forty years, died at his home in New York City on April 18. The news arrived just as May MACHINERY was going to press and a more complete obituary will appear in the June number.

WALTER A. FLETCHER, sales manager of the Western Division of E. F. Houghton & Co., Philadelphia, Pa., died recently in San Francisco, Calif. He started his career with the company in 1922.

New Books

HELICAL SPRING TABLES. By John D. Gayer and Paul H. Stone, Jr. 165 pages, 6 by 9 inches. Published by The Industrial Press, 93 Worth St., New York 13, N. Y. Price, $5.

This book is an easy-to-use index of over 6800 ready-designed compression and tension springs from which selections may be made with minimum calculation. Complete data for each spring is provided in tabular form, the tables being arranged in order of increasing spring diameter for convenience in locating a suitable spring for a specific application. Conversion factors are provided for cases where it is desired to use a different spring material, service life, or stress range, and worked-out examples show how these are applied.

A simple means of selecting ready-designed springs is of particular value when a small number, perhaps only one, spring is required. In such cases the spring may be made in the shop rather than by an outside manufacturer. Since helically wound compression and tension springs are the two types most commonly used, it is the purpose of this book of tables to: (A) provide an easy-to-use index of ready-designed compression and tension springs from which selections may be made with minimum calculation to meet a wide range of design requirements; (B) provide factors for modifying the tabulated data to suit such requirements as regards spring material, service life, and deflection; (C) provide data for use in preliminary designs where it is important to know in advance the space requirements of the springs to be used; (D) provide data that can be used as a starting point in the design of springs to exacting specifications.

The book is divided into four sections: Section 1—Instructions for Using the Compression Spring Tables; Step-by-Step Examples of How the Tables are Used; Table of Life, Stress, and Material Conversion Factors. Section 2—Tables of Compression Springs Arranged by Coil Diameters of from 1/8 Inch to 4 Inches. Section 3—Instructions for Using the Tension Spring Tables; Step-by-Step Examples of How the Tables Are Used; Table of Life, Stress, and Material Conversion Factors; Chart for Determining Initial Tension in Tension Springs; Various Styles of Tension Spring Ends. Section 4—Tables of Tension Springs Arranged by Coil Diameters of from 1/8 Inch to 2 Inches.

Included in Sections 2 and 4 are the following spring data: free length in inches; maximum deflection; length at maximum load; wire diameter; number of active turns; and spring rate in pounds per inch. This data is given for each spring.

HOLES, CONTOURS AND SURFACES. By Richard F. Moore and Frederick C. Victory, 424 pages, 6 3/4 by 10 inches. Published by Moore Special Tool Co., Bridgeport, Conn. Price, $5.

This book covers exhaustively the methods and equipment that help to provide solutions to the metal-working industry's problem of accurately locating and machining holes, contours, and surfaces. Developments in the field of jig boring and jig grinding are discussed, as well as the subject of linear form grinding, which is based on the performance of a newly-developed machine for this purpose. There are approximately 500 illustrations and 184 pages of Woodworth Hole Location Tables for converting holes on circles to rectangular coordinates. Thus, it is, primarily, a technical book for the tool engineer, the process engineer, toolmaker, jig borer and grinder operator.

Chapter headings are as follows: The Problem of Location; Improved Location Equipment and Methods; The Foundation of Accuracy; Engineered Location Equipment Standards; The Coordinate Locating System; Jig Boring Principles and Applications; Jig Boring Practices; Jig Grinding Principles and Applications; Jig Grinding Holes; Jig Grinding Contours; Linear Form Grinding Principles and Applications; Linear Form Grinding Practices; Inspection Methods; and Precision Pays Dividends.

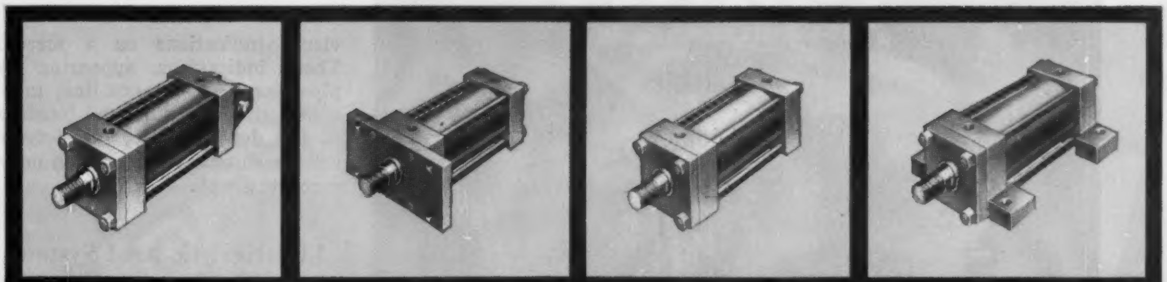
SERVOMECHANISMS AND REGULATING SYSTEM DESIGN, Volume II. By Harold Chestnut and Robert W. Mayer. 384 pages, 5 3/4 by 9 inches. Published by John Wiley & Sons, Inc., New York City. Price, $8.50.

Volume II is devoted to the needs of the practicing designer. The book states the problems met in the design of regulators and feedback control systems, and develops methods for their solution. Although an analytical approach is employed, the emphasis has been placed on practiced design.

Chapter headings are as follows: Measurement Techniques; Influence of Input Characteristics on Control System Design; Selection of Controlled System Power Element with Proper Rating; Networks for Obtaining Desired Attenuation—Frequency Characteristics; Amplifier Design; All Alternating-Current Sevomechanism Operation; Linearization of Non-Linear Elements for Small Departures; Linearization of Non-Linear Elements for Large Departures; and Application of Non-Linear Elements to Control Systems.

ELECTROPLATING ENGINEERING HANDBOOK. Edited by A. Kenneth Graham, 650 pages, 6 1/2 by 10 inches. Published by Reinhold Publishing Corporation, New York City. Price, $10.

Prepared by a staff of specialists in the field, this complete handbook is designed to answer every imaginable electroplating problem. There is up-to-date data on processing techniques and the engineering factors involved in constructing and installing plating equipment. Full chapters cover the design of parts to be plated, standards and specifications, processing sequences, testing of deposits, waste treatment, plating machinery, rinsing and drying, maintenance, and all other engineering and operating considerations. Also included are tables, charts, plans, and illustrations.

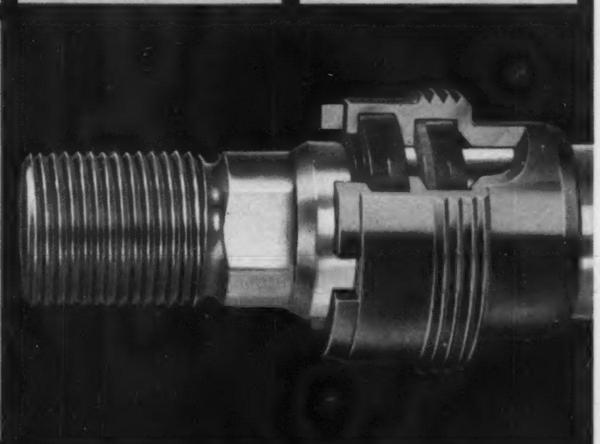


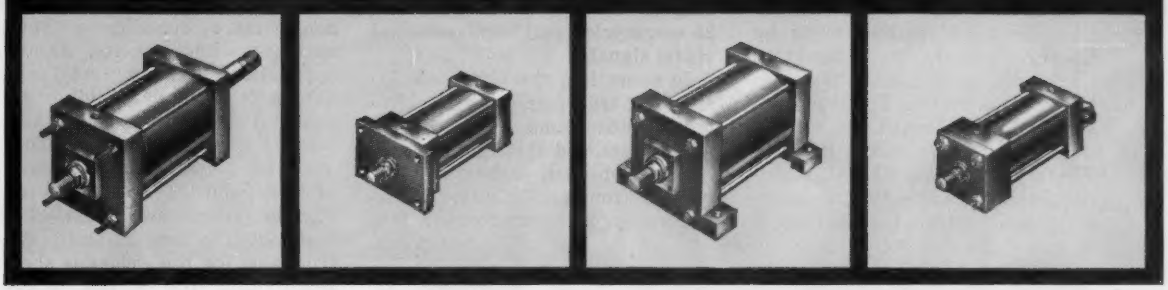
Series "H" Hydraulic Cylinders

9 bore sizes from 1½" to 8"...13 standard mountings, many combinations. Heavy-duty tie rods. Steel heads. Steel cylinder bodies "Tru-Bored" and honed to a satin finish. Piston rods ground and polished, then hard chrome plated for minimum friction and long packing life.

Series "A" Air Cylinders

11 bore sizes from 1½" to 14"...13 standard mountings, many combinations. Steel heads. Cylinders of hard-drawn, high-strength brass, honed to a satin finish. Piston rods ground and polished, then hard chrome plated for extreme smoothness as well as corrosion resistance.



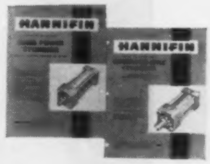


Only HANNIFIN Square-Type Cylinders Have This Revolutionary New Gland

The gland you see here represents the biggest improvement in cylinder design in the last 50 years. And, you'll find this gland only in Hannifin Square-Type Air and Hydraulic Cylinders.

This exclusive Hannifin Gland is a bronze cartridge, *externally removable and replaceable as a unit* to meet J.I.C. recommendations. The packing is new, too. Outside is the "Wiperseal." It serves a dual purpose as it *wipes both ways* to provide a dry rod on the out-stroke, a dirt-free rod on the in-stroke. Inside is the "Lipseal"...self-compensating, self-relieving and nonadjustable. It provides an efficient seal throughout its long life.

Find out how easily you can apply Hannifin Cylinders to your requirements. They're available for prompt delivery—in all sizes and all standard mounting styles—and at competitive prices despite all their exclusive features.



WRITE FOR BULLETINS

Bulletin 113. Series "H" Hydraulic Cylinders

Bulletin 213. Series "A" Air Cylinders

HANNIFIN

Hannifin Corporation, 509 S. Wolf Rd., Des Plaines, Ill.

Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

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Immersed ultrasonic inspection of jet-engine forgings is performed manually or semi-automatically with this installation.

Semi-Automatic Inspection of Jet-Engine Forgings

Both manual and semi-automatic inspection of wheel-shaped jet-engine forgings can be performed with the ultrasonic inspection system shown in the illustration. This installation, made by Sperry Products, Inc., Danbury, Conn., will be used in the Westinghouse Aviation Gas Turbine Division plant in Kansas City, Mo.

The system is called SIMAC-Westinghouse—the SIMAC standing for sonic inspection measurement and control. Included are a tank for immersed inspection, a Sperry UW Reflectoscope, and a pen recorder. The Reflectoscope is equipped with nine frequency ranges, between 200 kilocycles and 25 megacycles, and both aural and visual signals.

In operation, the ultrasonic instrument transforms electrical impulses into sound pulses, which are transmitted through the part being inspected. Reflections, or echoes, from any structural discontinuity are transformed into visual indications on a screen. These indications, appearing as pips along a reference line, indicate both the nature and location of the defects. Also, the defects can be automatically plotted on a circular graph.

Electrical Control System Has No Moving Parts

A reliable, maintenance-free electrical control system called "Cypak" has been announced by the Westinghouse Electric Corporation, Pittsburgh, Pa. The director system has no moving parts, and is suited for the control of complex machinery, processes, or other equipment. Basic components of the director system are special magnetic amplifiers and transistors, acting together as devices to replace relays.

Director systems have been built and tested in a number of operations including a fully automatic six-story elevator, a relatively simple punch-press control, and a much more complicated spiral milling-machine control. Another application is the control for an automatic bus-duct welding machine. This simple device automatically controls the repetitive positioning and welding of a piece of work, and the necessary starting, stopping, and interlocking features. The original relay control panel for the welder is shown below, and the Cypak system which replaces it, above, in the accompanying illustration.

Reliability and flexibility of the system will be extremely valuable in the control of complex operations involving many different machines. For example, the system can be applied to transfer machines having relay control panels 30 to 40 feet long and about 6 feet high and containing several hundred relays. The basic "building blocks" of the system are flat pieces of insulating material, about 5 inches square and 1/2 inch thick, on which one or two magnetic cores are mounted. The cores are wired in proper circuitry with the necessary resistors and capacitors. The transistor and magnetic elements can be operated at very low power levels.

Cypak control, seen at the top, having magnetic amplifiers and transistors to control an automatic welding machine, takes the place of original relay control panel shown below.

Arc welding of the Filter/Separator.

It has been found that minute traces of water in aviation gasoline can stop the engine when flying in low temperatures, as at high altitudes, or over the pole. The amount of water involved is so small that it would not bother an automobile carburetor. To remove it for safe flying requires a special Filter/Separator. All metal parts going into this filter were specified to be 90-10 Cupro-Nickel. One of the contractors for the U. S. Navy is the Bendix-Skinner Division of the Bendix Aviation Corporation, Royal Oak, Mich. When Bendix-Skinner obtained the order, it called in Revere's Technical Advisory Service. A complete study was made of the blueprints and specifications, in order to set up the most economical purchasing schedules. When production began, personnel from the Welding Section of the Research and Development Laboratory maintained by Revere in Rome, N. Y., went to the Bendix-Skinner plant to share their know-how with the welders, so as to be sure the welds would pass strict inspection, yet be made at competitive costs.

Cupro-Nickel, 90-10, is highly resistant to corrosion and other forms of attack. Because it contains only 10% nickel, it is more economical than the richer alloys, yet in many applications just as satisfactory. We suggest you look into it.

Gasoline Filter/Separator made by Bendix-Skinner Division almost entirely of Revere 90-10 Cupro-Nickel.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

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Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

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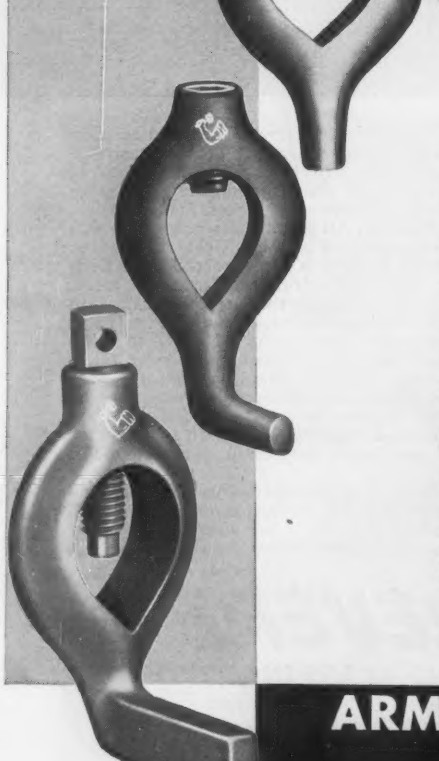

NOT A COST, BUT AN INVESTMENT

That Pays Year After Year . . .

Buy ARMSTRONG TOOL HOLDERS and TOOLS for today's jobs and they will bring you added profits thru the years. With ARMSTRONG TOOL HOLDERS you will be permanently tooled up for whatever comes, for each is a multi-purpose tool that takes cutter bits ground to many shapes. Each is an efficient tool, refined thru a half century of world wide use. Each has strength beyond any need, extra strength resulting from endless research and the most modern closely controlled manufacturing methods.

ARMSTRONG TOOL HOLDERS are inexpensive too, for they are produced in great numbers. They are instantly available because they are carried in stock by all leading supply houses in sizes and types for every operation on lathes, planers, slotters and shapers; for standard operations on turret lathes and screw machines. They are profitable in use because they permit the highest speeds and heaviest feeds and "Save: All Forging, 70% Grinding and 90% High Speed Steel."

ARMSTRONG Lathe and Milling Machine Dogs are permanent tools too. They are drop-forged from special open hearth steel, are heat treated to extreme stiffness and toughness. They have alloy steel screws hardened at the tip to prevent up-setting and have double life, for hubs are made oversize to permit re-tapping.

ARMSTRONG Quality pays back over and over again. *Write for new S-48 catalog.* It offers many opportunities to conserve profits.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5213 W. ARMSTRONG AVENUE • CHICAGO 30, ILL.

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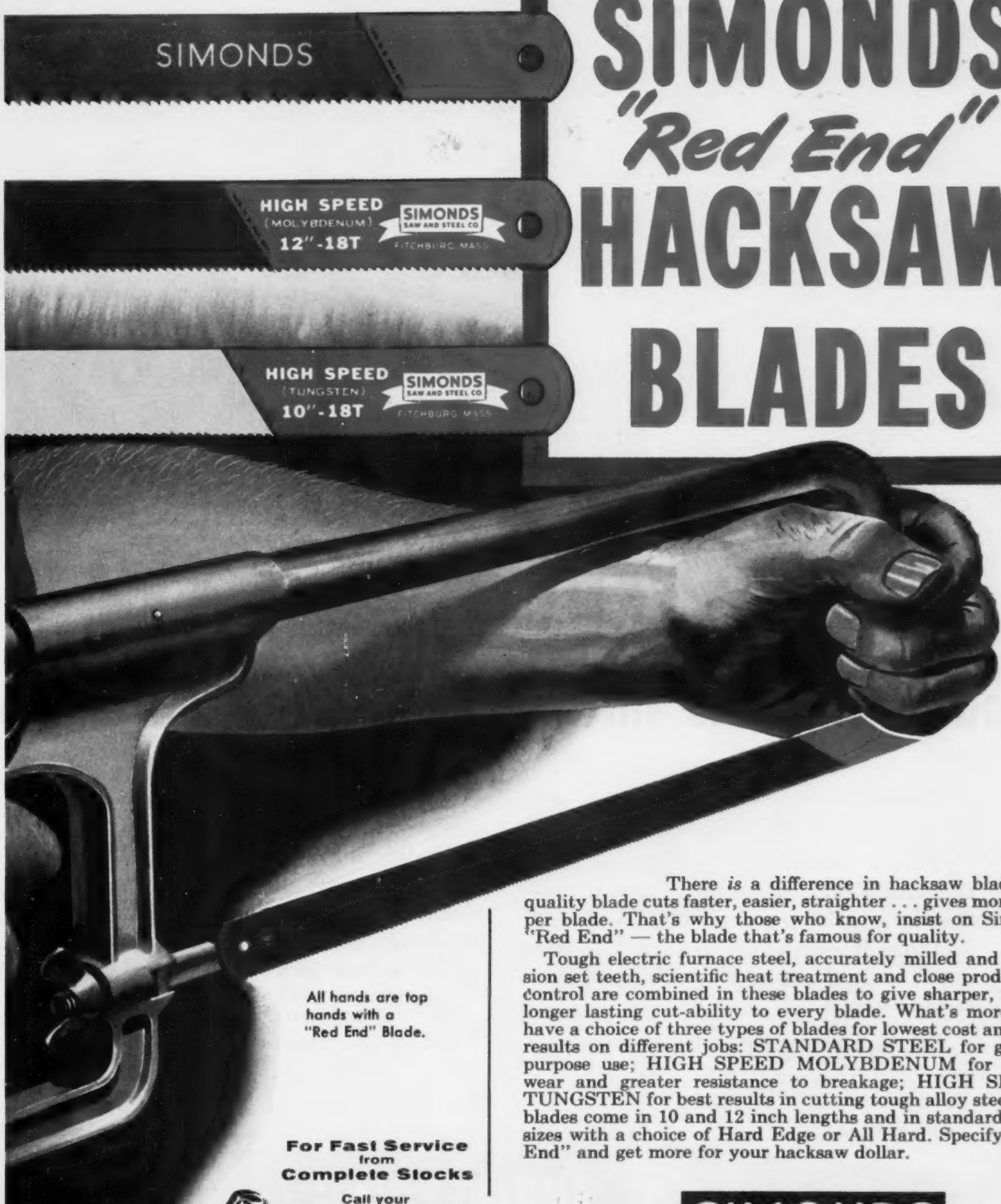
For Quick and Easy Cutting

SIMONDS "Red End" HACKSAW BLADES



All hands are top hands with a "Red End" Blade.

There *is* a difference in hacksaw blades. A quality blade cuts faster, easier, straighter . . . gives more cuts per blade. That's why those who know, insist on Simonds "Red End" — the blade that's famous for quality.

Tough electric furnace steel, accurately milled and precision set teeth, scientific heat treatment and close production control are combined in these blades to give sharper, faster, longer lasting cut-ability to every blade. What's more, you have a choice of three types of blades for lowest cost and best results on different jobs: STANDARD STEEL for general purpose use; HIGH SPEED MOLYBDENUM for longer wear and greater resistance to breakage; HIGH SPEED TUNGSTEN for best results in cutting tough alloy steels. All blades come in 10 and 12 inch lengths and in standard tooth sizes with a choice of Hard Edge or All Hard. Specify "Red End" and get more for your hacksaw dollar.

For Fast Service from Complete Stocks
Call your
SIMONDS Industrial Supply DISTRIBUTOR

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

*Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon
Canadian Factory in Montreal, Que. Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.
Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada*

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does MORE work... MORE easily

new POWER FEED HEAD

U. S. Vertical Miller

Write for descriptive folder

Here's the new U. S. Vertical Miller with Power Feed Head – the head into which U. S. has built all the most wanted features without sacrificing traditional U. S. simplicity. Check its infinitely variable feed rate, its 800 pounds of down thrust on the quill, its supplemental hand feeds – it is the milling head that was designed to meet all shop needs.

Add to these the basic advantages of the U. S. Vertical Miller. You can easily see why it's the milling machine that "does more work more easily."

Detailed literature on request.
The U. S. Burke Machine Tool Division.
17 Brotherton Road, Cincinnati 27, Ohio.

more versatile
Feed infinitely variable from .002" to .008" while in operation

greater capacity
5½" power quill travel; 800 lb. down thrust

more convenient
Supplemental hand feeds

increased rigidity
Enclosed hard chrome plated quill with internal lock

THE **U ★ S ★ Burke** MACHINE TOOL DIVISION

For more information on products advertised, use Inquiry Card, page 253

For more information on products advertised, use Inquiry Card, page 253

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Dv. Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., 25 Main St Ansonia, Conn.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc
New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chcago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page* 274)

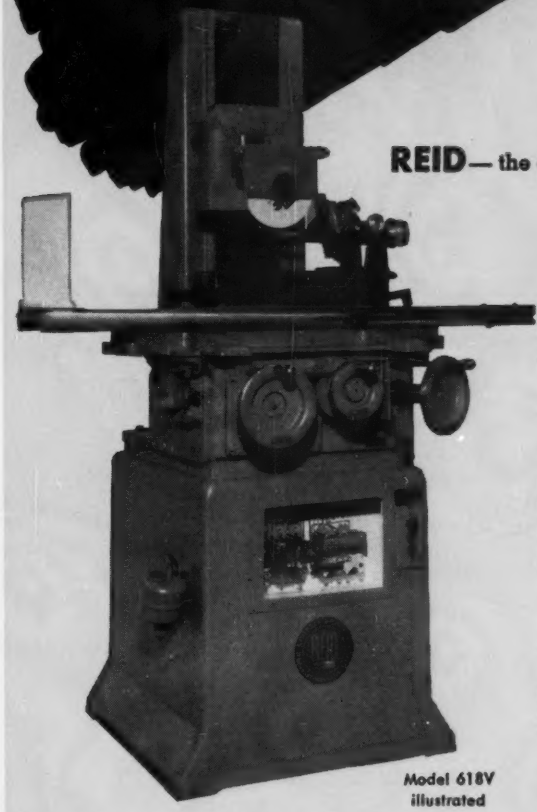
CAN YOUR SURFACE GRINDERS MEET TODAY'S DEMANDS?

Many over-age surface grinders now being used simply cannot measure up to the precision tooling needs of modern, efficient plants.
If you're operating one of these over-age grinders it's time you changed grinders.

PLAN NOW FOR REPLACEMENT

with REID GRINDERS

REID— the choice of industry for precision grinding



Model 618V illustrated

EASIER OPERATION

. . . finger-tip level controls eliminate stretching and bending, lessen operator fatigue. And, electrical controls are fully visible, yet protected behind a transparent shatter-proof panel.

BETTER SURFACE FINISHES

. . . hand scraped ways for smooth running; a motorized spindle turning on pre-loaded bearings, to eliminate wheel chatter, produce ground pieces with visibly finer surface finish.

RUGGED DESIGN

. . . all mechanical units built around rugged one-piece column casting to insure permanent alignment of cross-slide saddleways and vertical headways. Column is mounted on heavy cast iron base for maximum rigidity and freedom from vibration.

ECONOMICAL

. . . in both *initial cost*, and continued, trouble-free operation, Reid grinders are quality engineered throughout to provide accuracy and dependability.

CAPACITY

. . . 6" x 18" x 17¼" (from center of spindle to work-table). Choice of four models: either hand feed table, or power feed table with speed variable from 12 to 35 feet per minute. Complete accessories for wet or dry grinding and special operations are available.

Be ready for today's competition and a profitable future —

with **REID GRINDERS**

see our catalog in
MACHINE TOOL CATALOGS
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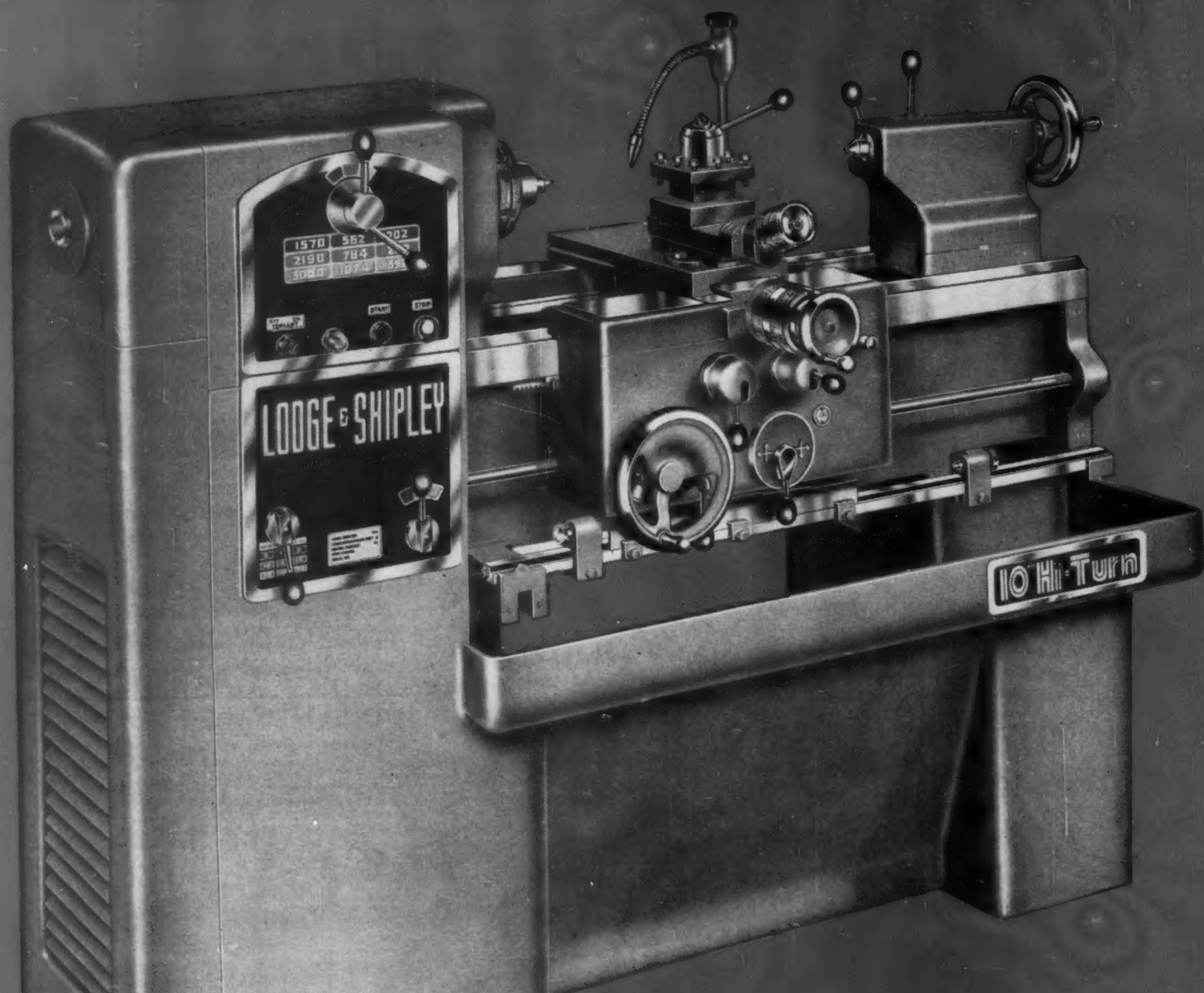
Please request Catalog 618-2

Reid Brothers Company, Inc.

PRECISION REID SURFACE GRINDERS

BEVERLY, MASSACHUSETTS

NEW LODGE & SHIPLEY 10"



• Look to Lodge & Shipley For Lathe Leadership

*Above price is FOB CINCINNATI, OHIO and is exclusive of applicable taxes customarily paid by the buyer.

***SEE IT* NOW! and *SEE IT* AT THE MACHINE TOOL SHOW, SEPTEMBER 6-17**

BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Olsen, Tinius, Testing Mch. Co., Willow Grove, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mich. Tool Co., 2531 11th St., Rockford, Ill.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

BALL BEARING TESTERS

Micrometrical Mfg. Co., 321 S. Main St., Ann Arbor, Mich.

BALLS

Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel

Allegheny Ludlum Steel Corp., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Rooler Bearing Co., Canton, Ohio
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy

Bunting Brass & Bronze Co., Spencer & Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Johnson Bronze Co., New Castle, Pa.

(*Continued on page* 276)

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For more information on products advertised, use Inquiry Card, page 253

BEARINGS, Lineshaft
Fafnir Bearing Co., New Britain, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle
Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Roolway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Self-Lubricating (Oilness)
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BELT SHIFTERS
Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, Transmission
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.
Consolidated Mch. Tool Corp., 656 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.

(*Continued on page* 278)

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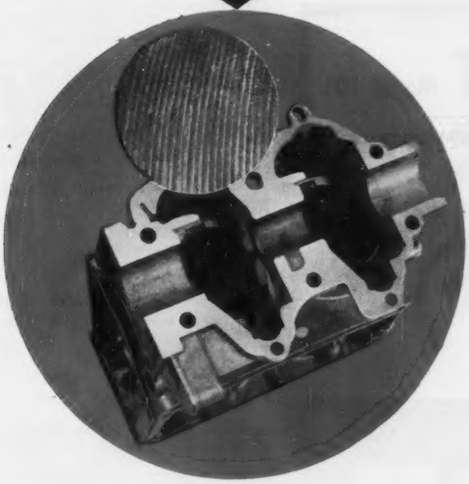
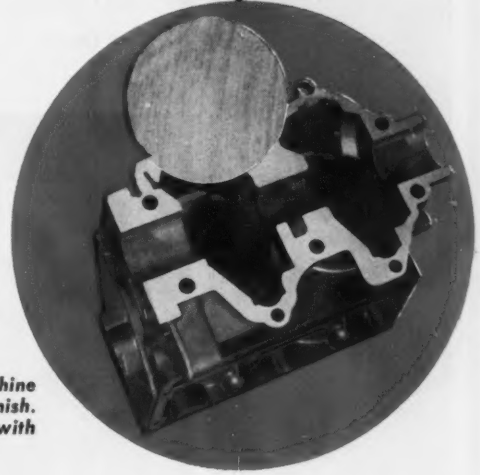
you can SEE the difference

Four times smoother finish when part is milled with Onsrud high speed, high feed milling machine . . .



standard milling machine produces a 125 micro inch machine finish. Part was milled at 40 ipm, at 1,200 RPM cutter speed.



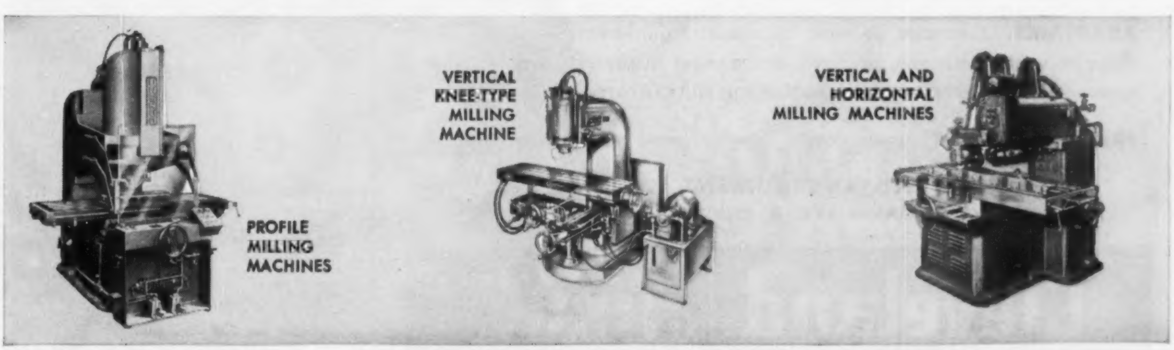
Onsrud A-245 Milling Machine produces a 32 micro inch finish. Part was milled at 70 ipm with cutter speed of 7,500 RPM.

HERE'S PROOF!

. . . that high spindle speeds are needed for effective milling of non-ferrous metals. Here is a graphic demonstration of one of the important advantages of Onsrud high speed milling machines . . . the advantage of smoother, finer finish at high production speeds. The part machined was an aluminum alloy outboard motor cylinder block. Since Onsrud milling machines are specially built for non-ferrous milling, you will find them consistently faster and more accurate for every type of milling job. Your inquiry for complete information is invited. We will be happy to supply a production analysis without charge.

ONSRUD MACHINE WORKS, INC.

3940 Palmer Street • Chicago 47, Illinois



BENDING MACHINES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg Co., Chambersburg, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machne & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.

BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.

BLAST CLEANING EQUIPMENT

Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

BLUING LAYOUT

Dykem Co., 2303P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES

Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only)
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOOKS, Technical

Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.

(Continued on page 280)

For more information on products advertised, use Inquiry Card, page 253

Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING AND TURNING MILLS, Vertical

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

BORING BARS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING, DRILLING AND MILLING MACHINES, Horizontal

(Floor, Planer or Table Types)

Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Portage Machine Co., 1069 Sweitzer Ave., Akron 11, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.

(*Continued on page* 282)

For more information on products advertised, use Inquiry Card, page 253

McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Taft-Peirce Mfg Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Bryant Chucking Grinder Co., Springfield, Vt.
Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING TOOLS

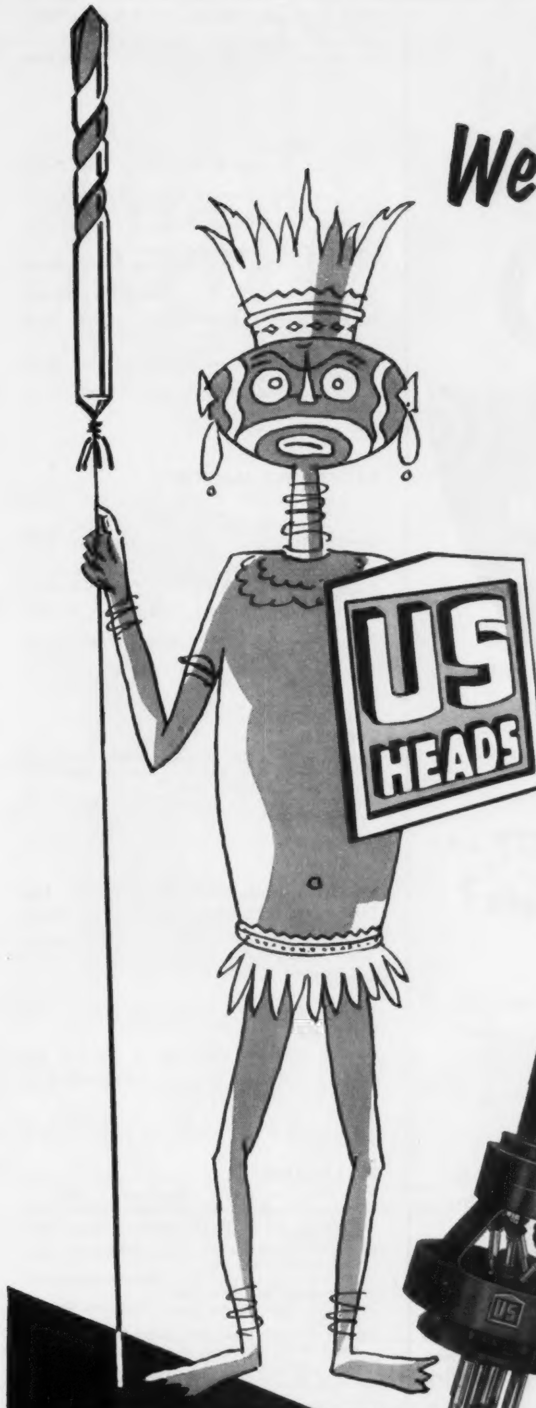
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13 Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bliss, E. W., Co., 1375 Raff Road, S. W. Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves. Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.

(*Continued on page* 284)

For more information on products advertised, use Inquiry Card, page 253



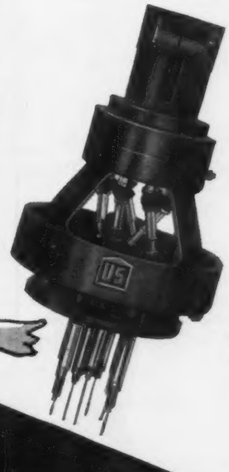
We're Looking for Head Hunters!....

Most machine tool men have long relied upon the "US" Adjustable Multiple Spindle Drill Heads. But we are looking for those who still haven't tried them . . . and who are looking for the best.

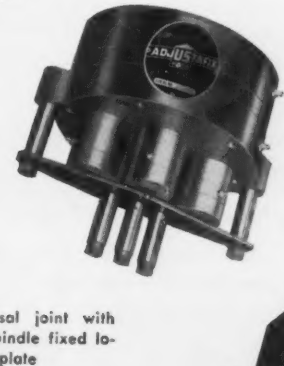
With their quick-change universal joint assemblies, they are built for continuous use, with full anti-friction bearing construction for high capacity thrust loads. The universal joint adjustable multiple spindle type is suitable for any sensitive drilling machine. Joints are self-lubricating. All gears are hardened and shaved with spindles superfinished.

The single eccentric type is used for equally spaced holes on bolt circles.

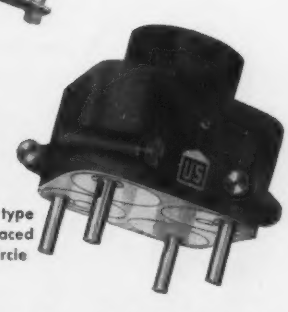
The new double eccentric AdjUStafix, two to eight spindles, permits spindles to be located in non-symmetrical patterns. It eliminates expensive change in set-up.



Universal joint with slip spindle fixed locating plate



Double eccentric type for irregular spacing



Single eccentric type for equally spaced holes on bolt circle

Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear-driven adjustable, fixed center, or individual lead screw tapping heads.

UNITED STATES DRILL HEAD COMPANY

616-618 BURNS STREET • CINCINNATI 4, OHIO

Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Shearcut Tool Co., Reseda, Cal.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Zagar Tool Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.
Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.

BUFFERS

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BURS

See Files and Burs, Rotary

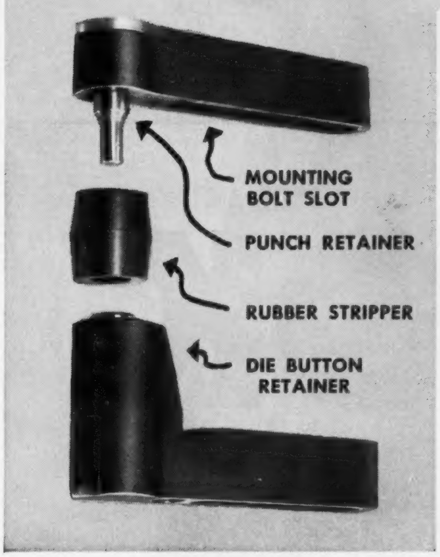
BUSHINGS, Brass, Bronze, Carbide, Etc.

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Unon Carbide & Carbon Corp., 30 E. 42nd St., New York.
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

(*Continued on page* 288)

For more information on products advertised, use Inquiry Card, page 253

NOW! PUNCH & DIE BUTTON POSITIONING *Flexibility* with R-B *Flex-Mount* RETAINERS

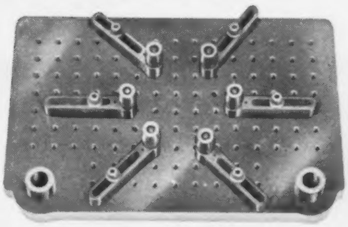


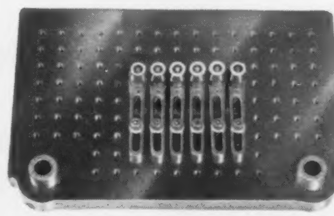
Cut your set-up time for short production runs on light gauge metals . . . R-B Flex-Mount Retainers permit quick, easy and flexible mounting of punches and die buttons. For, Flex-Mount Retainers are easily bolted in any desired position on T slotted or drilled and tapped commercial die sets.

Standardized R-B punches and die buttons (round, square, oblong or special shapes to customer specifications) are used in these retainers. Stripping is accomplished with R-B rubber strippers or R-B rubber covered springs to eliminate costly metal strippers, retainer screws and springs.

TYPICAL *Flex-Mount* POSITIONING *Flexibility*

Shown are but two of an almost unlimited number of mounting arrangements that can be made with Flex-Mount Retainers.





Use R-B Engineering Service for Your Tough Piercing Problems

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 78 • 12619 BURT RD. • DETROIT 23, MICHIGAN

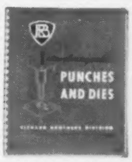
Please send me additional information.

NAME________ TITLE________

COMPANY________

ADDRESS________

CITY________ ZONE____ STATE________

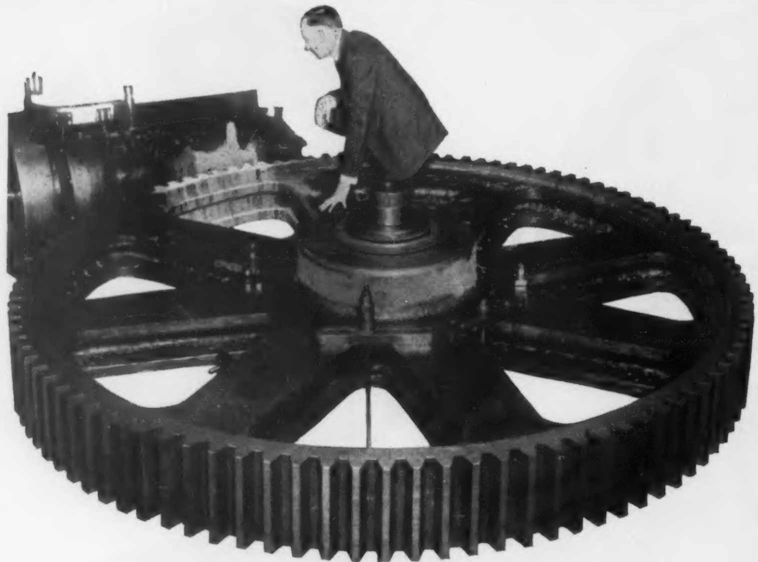


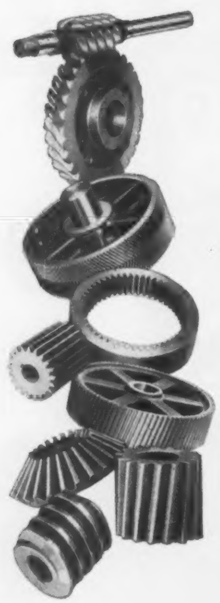
Also Produced in
OTHER ALLIED PLANTS
SPECIAL COLD FORGED PARTS
STANDARD CAP SCREWS
PRECISION GROUND PARTS
SHEET METAL DIES MADE OF FERROUS ALLOYS, ZINC ALLOYS OR PLASTICS

For more information on products advertised, use Inquiry Card, page 253

P-K Socket Screw Distributor

For more information on products advertised, use Inquiry Card, page 253





BUSHINGS, Hardened

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS

Ames, B. C., & Co. (Dial) Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starret, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

Allegheny Ludlum Steel Corp., Pittsburgh, Pa
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Valenite Metals Corp., Box 205, Royal Oak, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Corp., 1340 W. Vernor Hwy., Detroit 1, Mich.

CASEHARDENING FURNACES

See Furnaces, Heat-Treating

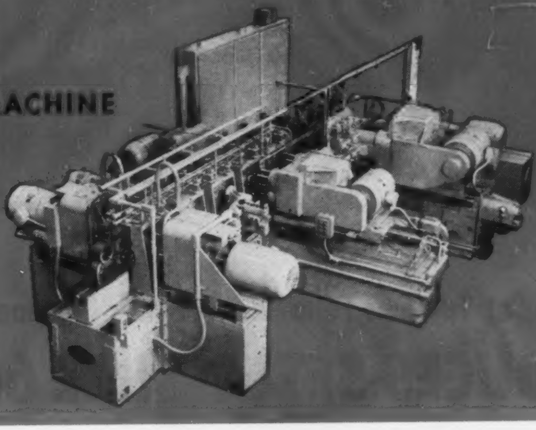
(*Continued on page* 290)

10 Station Automatic In-Line

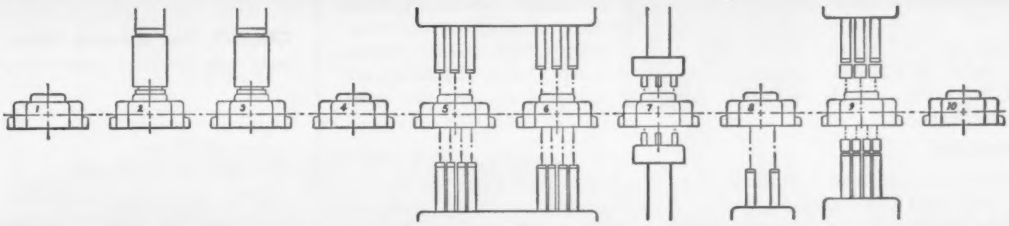
BAKER TRANSFER MACHINE

Performs Multiple Operations on Tractor Housings

THE MACHINE



THE PART



THE OPERATIONS

STATION NO. 1
LOAD 1 PART

STATION NO. 2
UNIT NO. 1
COMB. SEMI. FIN. BORE 5.165 & 3.249 & 2.861 DIAS.
COMB. SEMI. FIN. BORE 4.425 THRU BOTH WALLS

STATION NO. 3
UNIT NO. 1
COMB. FIN. BORE 5.180 & 3.264 & 2.876 DIAS.
COMB. FIN. BORE 4.440 THRU BOTH WALLS

STATION NO. 4
IDLE

STATION NO. 5
UNIT NO. 2 "U" DRILL 5 HOLES
31/64 DRILL 6 HOLES

UNIT NO. 3 31/64 DRILL 8 HOLES
21/32 DRILL 1 HOLE
"U" DRILL 6 HOLES
23/32 DRILL 1 HOLE

STATION NO. 6
UNIT NO. 2 ½ CHAMFER 5 HOLES
⅝ CHAMFER 6 HOLES

UNIT NO. 3 ⅝ CHAMFER 7 HOLES
13/16 CHAMFER 1 HOLE
½ CHAMFER 6 HOLES
23/32 DRILL 1 HOLE
COMB. COUNTERBORE
.796 & CHAMFER 1 HOLE

STATION NO. 7
INSPECTION

STATION NO. 8
UNIT NO. 4
.6910 REAM 1 HOLE
.8157 COUNTERBORE 1 HOLE

STATION NO. 9
UNIT NO. 5 7/16-14 N.C. TAP 5 HOLES
9/16-12 N.C. TAP 6 HOLES

UNIT NO. 6 7/16-14 N.C. TAP 6 HOLES
9/16-12 N.C. TAP 7 HOLES
½-14 N.P.T. TAP 2 HOLES

STATION NO. 10
UNLOAD 1 PART

Whatever Your Specific Job Problem, Consult Baker Engineers. Write

BAKER BROTHERS, INC., TOLEDO, OHIO

DRILLING • TAPPING • KEYSEATING • CONTOUR GRINDING MACHINES

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Die

American Brass Co., Waterbury 20, Conn.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Madison-Kipp Corp., Madison, Wisc.

CASTINGS, Iron

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.

CASTINGS, Steel, Alloys, Etc.

Allegheny Ludlum Steel Corp, Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Haynes Stellite Dv., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CENTERS, Lathe

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Dakon Tool & Machine Co., Inc., 1836 Guilford Ave., New Hyde Park, N. Y.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page* 292)

"King-size" turning jobs call for Nebel power, speed and accuracy

You need the ample facilities of Nebel lathes to turn heavy jobs like this huge steel mill roll. The 36″ Nebel 'F' series heavy duty engine lathe – shown on the job at Lukens Steel Company, Coatesville, Pa. – has the stamina to support such enormous loads . . . and the *power* to turn them *quickly* and *accurately* day after day.

Secret of Nebel performance is in the Nebel engineered headstock – now equipped with shaved and hardened steel gears and Timken anti-friction bearings throughout.

Performance plus price. Only Nebel brings you the combination of outstanding performance and low price. Nebel engine lathes are made in six swing sizes, 16″ to 36″. Write today for descriptive bulletins.

The Nebel Machine Tool Co.,
3410 Central Parkway, Cincinnati 25, Ohio.

Nebel
LATHES
CINCINNATI

For the newest in metal turning equipment, see our booth at the Machine Tool Show.

C Product Directory

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

CHUCKING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co., (Single and Multiple Spindle) 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

CHUCKS, Drill

Almond, T. R., Mfg. Co., 4621 Beidler Rd., Willoughby, Ohio
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

(Continued on page 294)

one must set the example

. . . *and with high speed steel*

it's REX

It's a real satisfaction when you set the example by what you make . . . when it becomes a *standard for comparison.* That's why Crucible is proud to have kept REX high speed steel tops in its class for so many years.

But don't take our word for REX's superiority. Try it on your own work. Compare its structure, finish, hardenability, carbide distribution and general uniformity. You'll see for yourself why it's the *standard* wherever high speed steels are used.

Remember, REX is made only by Crucible. So call for REX at your nearby Crucible warehouse, or for quick mill delivery – *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

For more information on products advertised, use Inquiry Card, page 253

CHUCKS, Gear
Gleason Works, 1000 University Ave., Rochester, N. Y.

CHUCKS, Lathes, etc.
Almond, T. R., Mfg. Co., 4621 Beidler Rd., Willoughby, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Prvoidence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

CLAMPS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.

Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal
Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

CLUTCHES
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Farrell-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine Wis.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

COLLARS, Safety
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

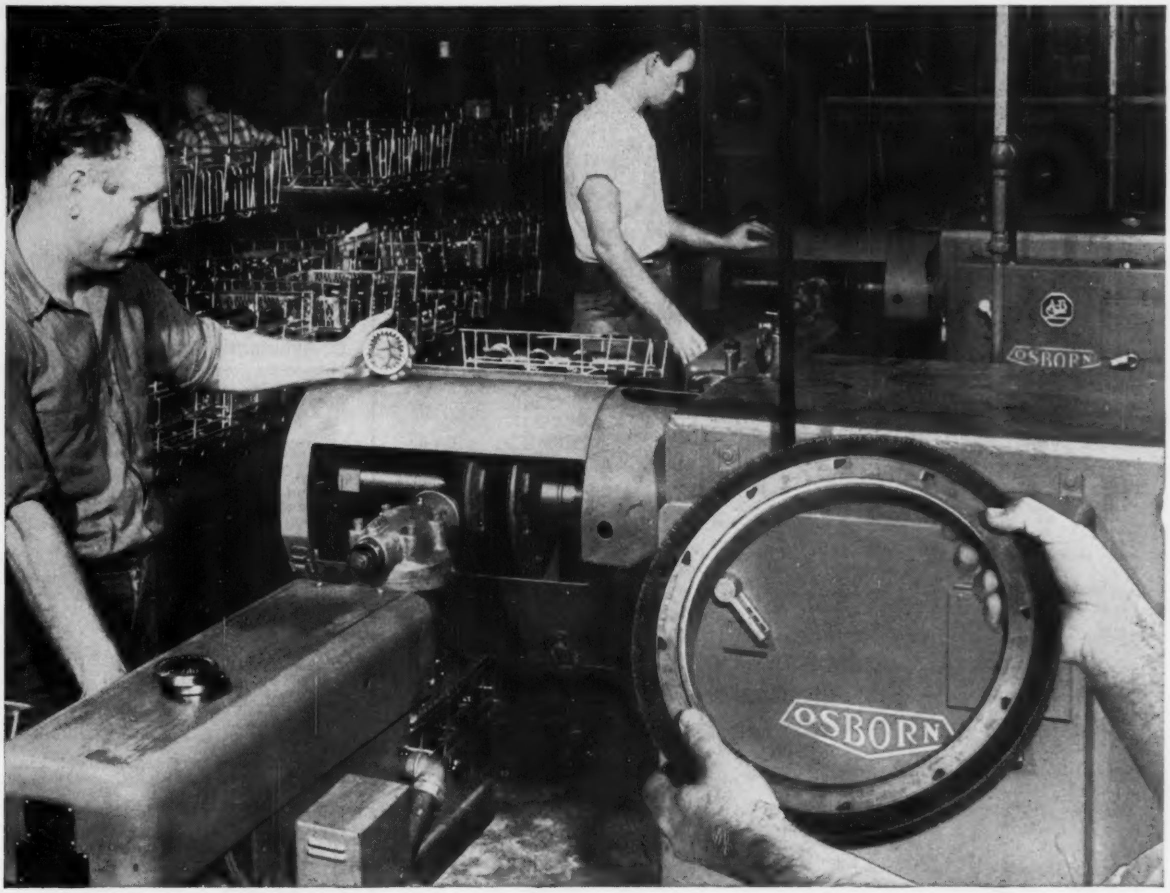
COMPARATORS
See Gages, Comparator.

COMPARATORS, Optical
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

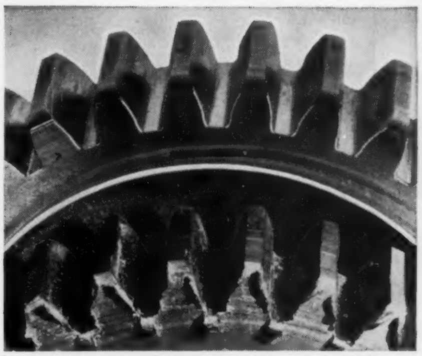
COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lopping).

(Continued on page 296)



Remove burrs faster with this push-button method

An OBA will show you how



IMPROVED GEAR QUALITY. *This before-after view of gears shows how Brushamatics remove burrs and blend surface junctures. Result is fewer stress concentrations, longer gear life.*

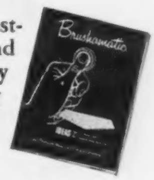
HERE, you see push-button power brushing removing burrs *and* blending surface junctures on automotive gears faster than any other method.

Operating automatically on preset time cycles, two Osborn Brushamatic* machines maintain strict uniformity of quality at a rate of more than 2000 gears a day.

And, in another plant, a manufacturer reports one Brushamatic saves more than 1000 manhours every year in finishing 17 different types of gears.

Why not have an **O**sborn **B**rushing **A**nalysis discover cost-cutting ways to solve your burr removal problems . . . and cleaning and finishing problems, too? Write for your copy of BRUSHAMATIC IDEAS. *The Osborn Manufacturing Co., Dept. D-29, 5401 Hamilton Ave., Cleveland 14, Ohio.*

*Trade-Mark



Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

For more information on products advertised, use Inquiry Card, page 253

Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

COMPOUNDS, Resin and Moulding
General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., Springfield, Vt.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Lees-Bradner Co., Cleveland, Ohio
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

CONTROLLERS
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

CONVEYORS FOR DUST, CHIPS, ETC.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

COOLANT SEPARATORS
See Separators, Oil or Coolant.

COUNTERBORES
Allen Mfg Co., 133 Sheldon St., Hartford 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.

(*Continued on page* 298)

For more information on products advertised, use Inquiry Card, page 253

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

COUNTERSHAFTS
Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13 Mich.
Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution
Brown & Sharpe Mfg Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S., Co., Athol, Mass.

COUNTING DEVICES
Starrett, The L. S., Co., Athol, Mass.

COUPLINGS, Flexible
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrell-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

COUPLINGS, Shaft
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Sier-Bath & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

CUTTER GRINDERS
See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.
(*Continued on page* 300)

CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. (Thread).
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tl. Co., Rochester, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burrs Rotary

CUTTING COMPOUNDS

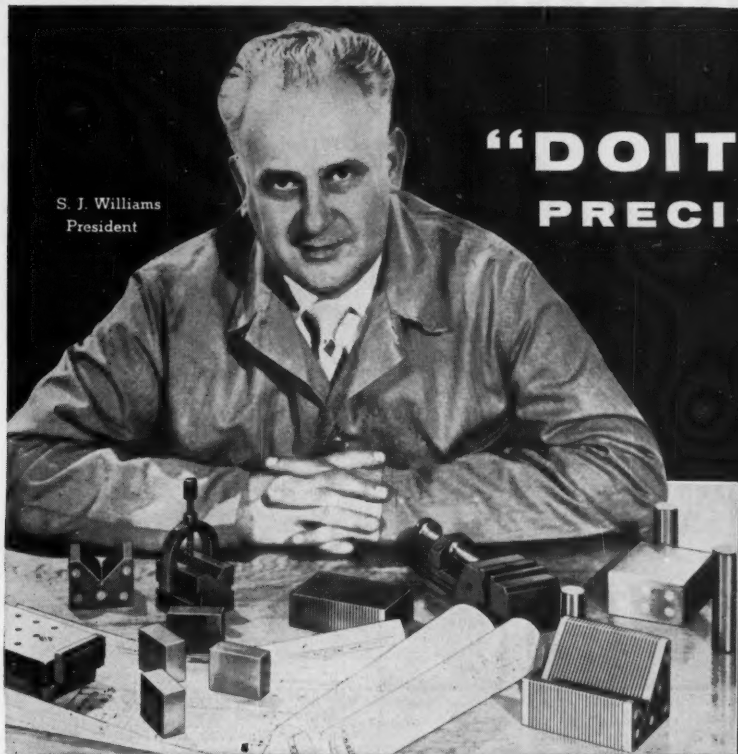
See Compounds, Cutting, grinding, Etc.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

(Continued on page 302)

TOOLMAKERS..MACHINISTS..APPRENTICES..STUDENTS..MANUFACTURERS..MACHINE SHOPS



NEW "DOIT" URSLF PRECISION TOOLS

Slash the cost of toolmaker's tools!

and make possible greater earnings for metal workers . . . greater savings for the companies that employ them!

do better work! get better pay!

Could you do better work if you owned better tools? Of course you could! You'd get better pay! That's why "DOIT" URSLF is so important! Up to now you may not have felt you could afford to buy such tools as these. But "DOIT" URSLF, a remarkable new approach to the manufacture of toolmaker's tools, cuts costs to the bone . . . allows you to own the very finest tools for pennies where otherwise you'd have spent dollars.

The "reason why" that makes these tremendous savings possible is simple:

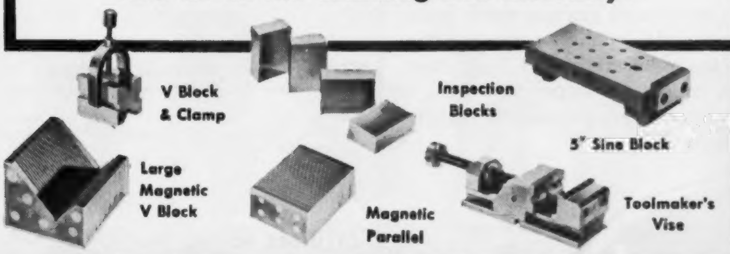
"DOIT" URSLF furnishes all materials!
"DOIT" URSLF gives you complete drawings and instructions!
YOU do all the finishing and assembly!

cut costs! cut labor! cut "down" time!

The cost-conscious machine shop or manufacturer will find hundreds of special applications for "DOIT" URSLF tools that will save time and money and add to the flexibility of expensive machinery.

The variety of magnetic tools, alone, offered by "DOIT" URSLF, will be impressive.

Assembling and finishing any "DOIT" URSLF tool is simple—even for a student or apprentice.



Distributors . . . Mill Supply Houses . . . Manufacturers' Representatives . . .
INQUIRIES INVITED!

S. J. WILLIAMS Precision Tool Kits, Inc.
makers of "DOIT" URSLF Precision Tools
4448 Soo Line Lane • Schiller Park, Ill.
PHONE—Gladstone 5-5200

WRITE FOR A FREE CATALOG TODAY!
Mail this coupon! You may paste it on a postcard if you wish!

S. J. WILLIAMS Precision Tool Kits, Inc.
4448 Soo Line Lane • Schiller Park, Ill.

Please send me the FREE "DOIT" URSLF Precision Tool Catalogue.

NAME____________________

ADDRESS____________________

CITY________ZONE_____STATE______

Ma-5

Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Landis Machine Co., Waynesboro, Pa., (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel

Allison Co., Bridgeport, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton 1 Ohio.
Wallace Tube Co., 1304-08 Diversey Pkwy., Chicago, Ill.

CUTTING-OFF MACHINES, Cold Saw

See Sewing Machines, Circular.

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Grob, Inc., Grafton, Wis.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CUTTING-OFF WHEELS, Abrasive

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelpha 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

(*Continued on page* 304)

For more information on products advertised, use Inquiry Card, page 253

CYLINDERS, Air
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic
Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co. Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

CYLINDERS, Pneumatic
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.

DEALERS, Machinery
Falk Machinery Co., 18 Ward St., Rochester, N. Y.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

DEMAGNETIZERS
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Inc., Worcester, Mass.

DESIGNERS, Machine and Tool
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Specialty Mchry. Co., 287 Homestead St., Hartford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIAMONDS AND DIAMOND TOOLS
Christensen Diamond Prod., 1937 S. Second West, Salt Lake City, Utah
Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING
See Castings, Die.

DIE-CASTING MACHINES
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.

(Continued on page 306)

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St., Chicago, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES

Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Grob, Inc., Grafton, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.

DIE SETS, Standard

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.
Wales-Strippet Corp., North Tonawanda, N. Y.

DIE-SINKING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St. Racine, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIE-SINKING PRESSES

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

DIE STOCKS

See Stocks, Die

DIES, Sheet Metal, Etc.

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept. General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krupp Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Mullins Mfg. Corp., Salem, Ohio.
Niagara Mch. & Tool Wks. 683 Northland Ave., Buffalo, N. Y.
Richard Bros. Div. of Allied Products, 26500 Capitol Ave., Detroit 23, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Waltham Mch. Wks., Newton St., Waltham, Mass.

DIES, Threading

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg., Mansfield, Mass.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

DIES, Thread Rolling

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

DISCS, Abrasives

Besley-Welles Corp. (Abrasive Div.) 20 N. Wacker Drive, Chicago 6, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St. Beloit, Wis.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

DISINTEGRATORS

Elox Corp., 602 N. Rochester Rd., Clawson, Mich.

DIVIDING HEADS

See Indexing and Spacing Equipment.

DOWELL PINS

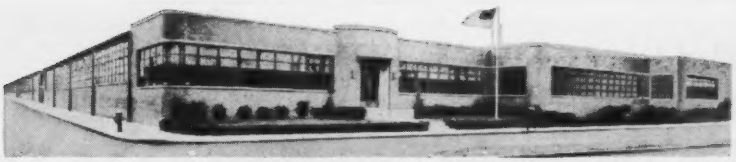
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRESSERS, Grinding Wheel

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32 Mich.
Metal Carbides Corp., Youngstown, Ohio.
Meyers, W. F. Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.

(*Continued on page* 308)

For more information on products advertised, use Inquiry Card, page 253



Now—**expanded plant, increased facilities open opportunity for additional manufacturers to**

GET GROUND TOOTH GEARS

at prices comparable to unground gears!

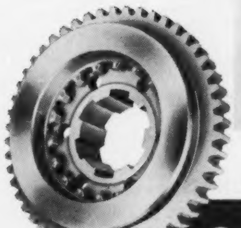
It's a fact! Sier-Bath can supply ground tooth gears to defined tolerances—dimensionally accurate, distortion-free, dependably uniform and with fine finish . . . at prices that make it uneconomical to risk the noise, shock, overloading and premature failure of less accurate, unground gears.

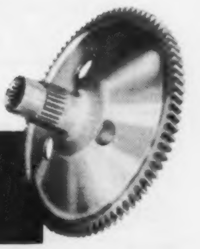
We are doing it for many of America's leading equipment manufacturers. We can do it for you. Send us specs and prints on your next gear requirements for quotation. Let us demonstrate how Sier-Bath's Precision Gear Clinic—high speed gear producing equipment—most modern techniques—and skilled gear technicians can bring you better gears at no greater cost.

Let us prove it! SEND YOUR NEXT GEAR SPECS TO *Sier-Bath*

Also . . . Gears Unconditionally Guaranteed to meet your requirements, when requested, through our Precision Gear Clinic

Straight and Coniflex Tooth Bevel Gears, 2" to 23", depending on ratio
Spur Gears, to 54" diameter
Helical Gears, to 54" diameter
Worm Gears, to 54" diameter
Worms to 12" diameter — ground thread
Worms to 6" dia.
Herringbone Gears, to 36" dia.
Instrument Gears—1" dia. and up
Internal Gears—to 36" O.D.
Gear Grinding. Involute and square splines, ground and unground





Sier-Bath PRECISION GEARS

Sier-Bath **GEAR and PUMP CO., Inc.**
9248 Hudson Boulevard North Bergen, N. J.

50th Anniversary

Mfrs. of Precision Gears, Rotary Pumps, Flexible Gear Couplings

Member A.G.M.A.

For more information on products advertised, use Inquiry Card, page 253

DRIFTS, DRILL

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 400 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Etto Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Govro-Nelson Co., Detroit 8, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St. Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STOPS

Wohlnip Products, Inc., 634 Central Ave., East Orange, N. J.

DRILLING MACHINES, Automatic

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros. Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.

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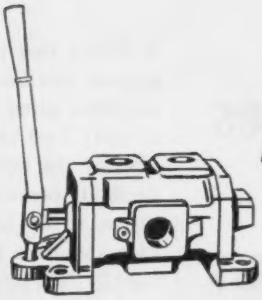
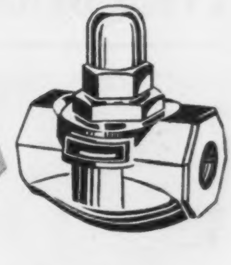
Logan HYDRAULIC VALVES......



Illustrated, Model 4095—4-way, 2-position valve for directing pressure alternately to ends of double-acting hydraulic cylinder.



Illustrated, Model 8015 adjustable speed control valve. Install between operating valve and one end of cylinder to meter flow of oil in one direction with free flow on return.

A broad range of types and sizes to most effectively meet any requirement—Design Engineers, Machine Operators, Maintenance Men appreciate these Logan advantages

- LONG-LIFE CONSTRUCTION
- EASY TO SERVICE
- INFREQUENT MAINTENANCE
- EASE OF INSTALLATION
- EFFORTLESS OPERATION
- UNRESTRICTED PORTING

On your products and in your plant, the enlarged line of standard Logan Hydraulic Control Valves offers many profitable advantages in selection, installation, use and maintenance. Standard Logan Hydraulic Valves are designed for 1500 psi service. The broad range of types and sizes makes it easy to select the most effective valve for every problem.

Balanced-pressure construction of these piston-type valves places identical pressure on both ends of the piston, thus providing effortless operation.

All ports and internal chambers are full pipe size with valve piston light in weight, thus assuring rapid response and fast reversal without excessive vibration or wear.

Highly compact design permits easy installation in restricted areas. Master control valves have four mounting feet located on end covers for easy mounting.

The valve body, which includes the ports, can be rotated 360° on the end covers to four positions at 90° intervals, when socket-head cap screws are removed from the covers. Permits convenient and efficient location of pipe connections. Alternate inlet ports, with one port plugged, provide added flexibility.

The ease with which pipe connections can be made often eliminates the necessity for costly special valves. Elimination of elbows, street ells, bends, etc. minimizes internal friction, thereby increasing efficiency and reducing costs.

The tough, wear-resistant alloy steel piston, hardened and ground, provides a close, sliding fit in the valve body. Both body and end covers are chrome nickel iron castings which furnish a good bearing surface to assure superior wearing qualities.

Both wear and maintenance are reduced in the Logan sliding-piston construction through elimination of valve seats and packing. The two stem seals at ends of piston are subject only to exhaust pressures.

With the removal of end covers, the standard seals are easily replaced and the piston may be removed from the vaive body for examination without disconnecting the piping.

Logan Hydraulic Control Valves offer many other advantages which assure longer, more effective performance and low maintenance.

For full information write for Logan Catalog 200-4.

Let Logan Engineers help you design your Air and Hydraulic Circuits. You will not be obligated.

Wherever there's a holding or motion requirement, there's a Logan design to do the job.

Member—National Tool Builders Assn.; National Fluid Power Assn.

LOGAN MANUFACTURES 7,023 STANDARD CATALOGED ITEMS

FREE CATALOG ON REQUEST

AIR CONTROL VALVES, Cat. 100-4 • AIR CHUCKS, Cat. 70-1 • AIR CYLINDERS, Cat. 100-1 • AIR-DRAULIC CYLINDERS, Cat. 100-3
AIR and HYDRAULIC PRESSES, Cat. 51 • COLLET GRIP TUBE FITTINGS, Cat. 200-5 • HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62

SAVES TIME · Logan · AIR AND HYDRAULIC EQUIPMENT · EFFORT·MOTION

LOGANSPORT MACHINE CO., INC., 810 CENTER AVE., LOGANSPORT, IND.

Consolidated Mch. Tool Corp., Rochester, N.Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Avey Drilling Mch Co., 126 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo.
Conedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

DRILLING MACHINES, BOILER

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

DRILLING MACHINES, Deep Hole

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Gang

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Horiz.

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.

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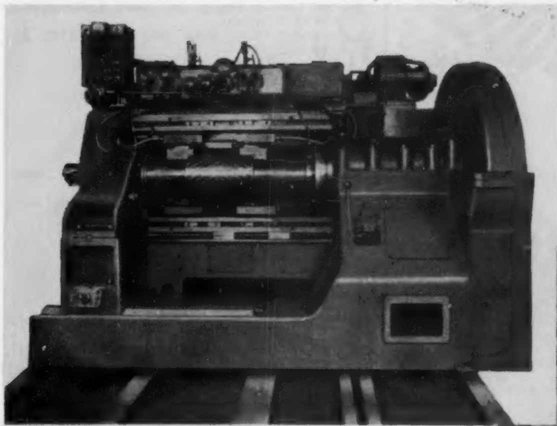
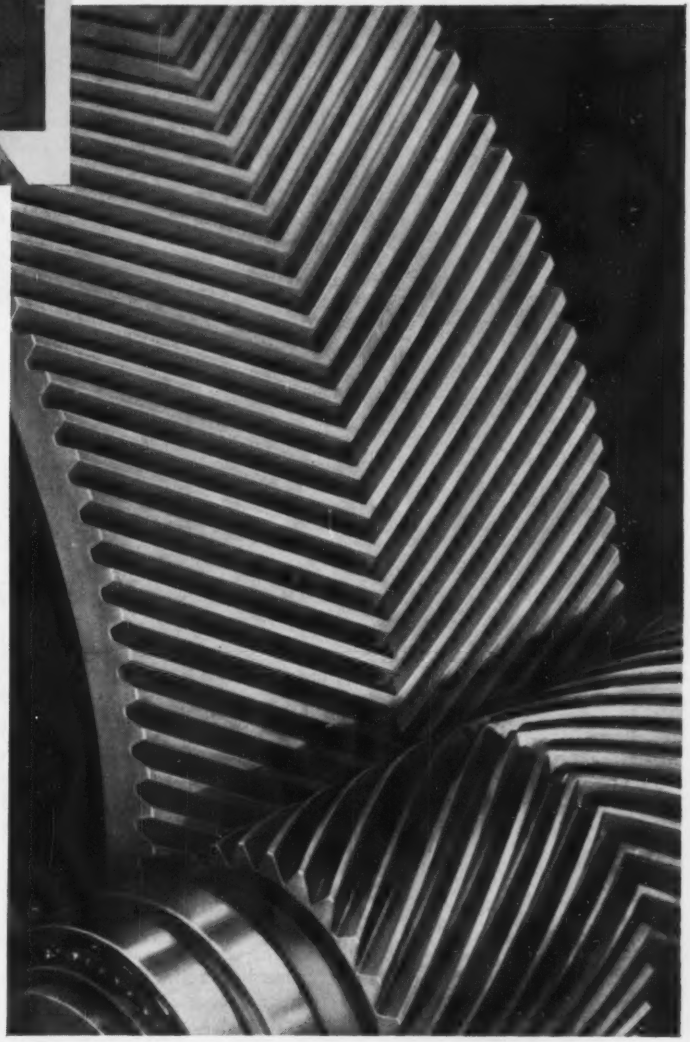
For more information on products advertised, use Inquiry Card, page 253

How to cut...



harder working gears



The Farrel-Sykes "Twin-Head" gear generator generates the two helices of a continuous-tooth herringbone gear simultaneously — without a center groove. Because there is no groove in the center, the entire face width of the gear performs useful work, providing extra strength and greater load-carrying capacity.

At the same time, the generator gives the gears extremely accurate tooth spacing, profile and helix angle. This pays off in smooth, quiet gear performance and prolonged gear life.

The "Twin-Head" generator also gives you versatility, high production and convenient operation. It makes fast, simple work of cutting every type of herringbone gear, single helical and spur gears, two members of a cluster gear at the same time, and other toothed and cylindrical forms.

Write for details of this accurate, versatile gear machine.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

Sales Offices: Ansonia, Buffalo, New York, Cambridge (Mass.), Akron, Cleveland, Chicago, Los Angeles, Houston.

FB-1006

Farrel-Birmingham®

Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mch., Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

DRILLING MACHINES, Multiple Spindle

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St. Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry, Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

(*Continued on page* 314)

For more information on products advertised, use Inquiry Card, page 253

. . . this "double-headed" Lempco press proved its **VERSATILITY** *for the makers of Johnson's Wax Lubricants!*

LEMPCO

can solve your special pressing problems, too!

Two heads proved better than one in solving the pressing problems encountered in the technical laboratory of S. C. Johnson & Son, Inc. . . . world famous manufacturer of wax products for home and industry.

The varied problems that arise in evaluating and testing wax lubricants and drawing compounds made a *versatile* press an absolute necessity. Lempco answered this need with this special press incorporating a unique arrangement of an electric operated ram and a hydraulic operated ram which are used independently of each other.

This is just one of many special presses that Lempco has designed and built for a number of America's largest companies.

TAKE YOUR PRESS PROBLEMS TO LEMPCO

. . . specialists in designing and building custom-made presses. In addition, Lempco has a full line of standard presses. So, whatever your press needs may be, special or standard, you can depend on Lempco to meet your requirements — *exactly.* Lempco engineering service endeavors to answer all inquiries within 48 hours.

Address all inquiries to* LEMPCO INDUSTRIAL, INC., 5500 *Dunham Road, Bedford, Ohio

BEDFORD **LEMPCO** OHIO, U. S. A.

For 35 Years - a Leading Builder of Machine Tools

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Upright

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th nad N. Sts., Richmond, Ind.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works, 3817 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS Center

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Spade

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.

DRILLS, Subland

Mohawk Tools, Inc., 910 E. Main St., Montpelier, Ohio.

DRILLS, Twist

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DUPLICATORS

Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DUST COLLECTORS

Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS

Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT

General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

EMERY WHEEL DRESSERS

See Dressers, Grinding Wheel

EMERY WHEELS

See Grinding Wheels

ENGRAVING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

EXTRACTORS, Drill

Wohlnip Products, Inc., 634 Central Ave., East Orange, N. J.

EXTRACTORS, Screw

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page* 316)

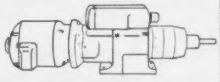
Swanson TURRET INDEXING UNITS

Lower the cost of Automation

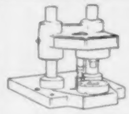
These versatile, "packaged" units provide the basic chassis for a wide range of special automatic machines for precision machining, processing or assembling operations on small and medium parts. Because they eliminate much of the engineering and building time formerly required, Swanson units lower costs and shorten completion time . . . considerably broadening the practical applications for automation. Further, because of the simplicity with which standard or special operational devices can be grouped around the turret, a wide latitude of tooling arrangements is possible. Interchangeable turret assemblies and mounting brackets are available for complete tooling changeover.

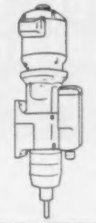
ONLY SWANSON PROVIDES A STANDARD TURRET INDEXING CHASIS WITH THESE FEATURES:

Stationary center plate for mounting or supporting operational devices.



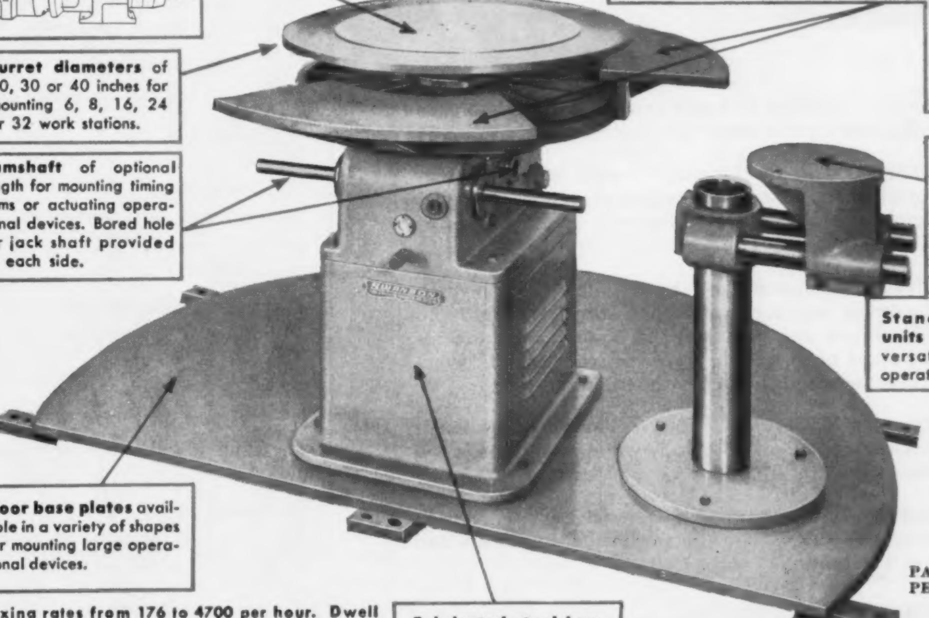
Mounting brackets of optional widths may be located on radial keyway in any positions around the turret.

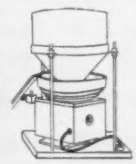




Turret diameters of 20, 30 or 40 inches for mounting 6, 8, 16, 24 or 32 work stations.

Camshaft of optional length for mounting timing cams or actuating operational devices. Bored hole for jack shaft provided on each side.





Standard pedestal units provide additional versatility in mounting operational devices.

Floor base plates available in a variety of shapes for mounting large operational devices.

PATENTS PENDING

Indexing rates from 176 to 4700 per hour. Dwell times from .5 seconds to 15.3 seconds with direct drive . . . to infinity with intermittent drive models. Exclusive cross-over cam and locking device assure harmonious indexing and accurate positioning at all work stations.

Fabricated steel base rigidly supports index housing and encloses motor, drive and wiring.

Write for Bulletin TM

Quality — SWANSON TOOL & MACHINE PRODUCTS INC., ERIE, PA. — Since 1919

ENGINEERS AND BUILDERS OF SPECIAL AUTOMATIC MACHINERY

FACING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating

Buffalo Forge Co., 490 Broadway, Buffalo N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic

Federal Machine & Welder Co., Overland Ave., Warren, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications

American Felt Co., Glenville, Conn.

FILES, Hack

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary

Mohawk Tools, Inc., 910 E. Main St., Montpelier, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Industrial Filtration Co. (Delpark Corp.) 15 Industrial Ave., Lebanon, Ind.

FINISHES FOR MACHINES AND METAL PARTS

Lowe Bros. Co., Dayton, Ohio.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Ransburg Electro-Coating Corp., 1234 Barth, Indianapolis, Ind.

FIXTURES, Kits For Building

Precision Tool Kits, Inc., 448 Soo Line Lane, Schiller Park, Ill.

FLEXIBLE COUPLINGS

See Couplings, Flexible

FLEXIBLE SHAFT EQUIPMENT

Pratt & Whitney, West Hartford 1, Conn.

FORGINGS, Machines (Upsetting)

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

FORGINGS, Drop

Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored

Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel

Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset

Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.

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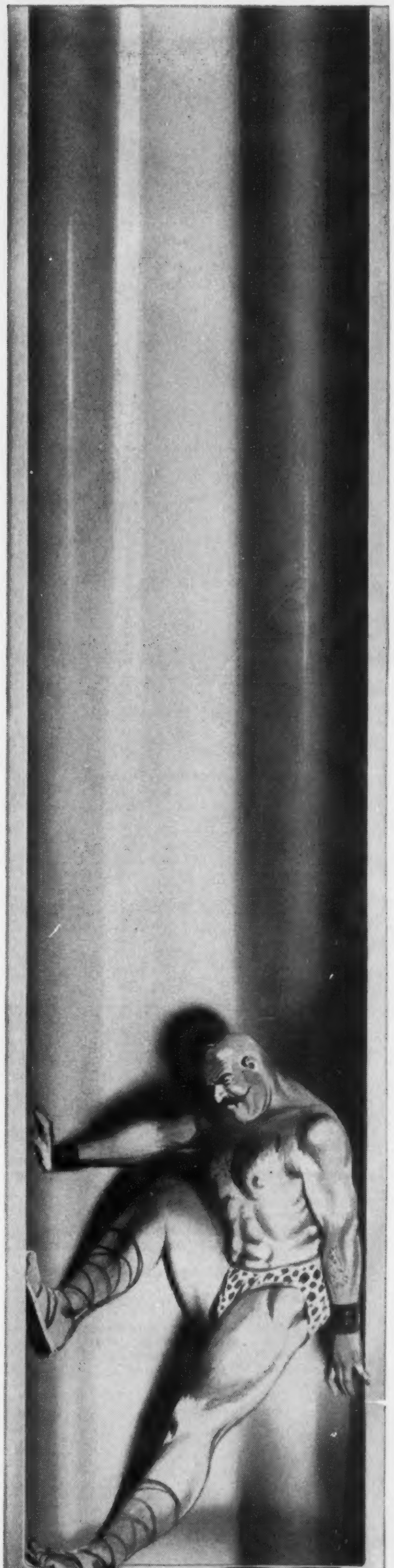
For more information on products advertised, use Inquiry Card, page 253



Could you wrap up 3000 psi a BETTER way ?

• The Mullins *Koldflo** Process *cold extrudes* this accumulator shell, which operates at 3000 psi, and withstands 12,000 psi burst pressure. For high-pressure service in hydraulic starting systems, this one-piece design is ideal. It eliminates assembly of forgings and tubing required with conventional designs, eliminates an O-ring seal as well.

Extruded with integral end to finished dimensions, *Koldflo* accumulator shells can wrap up *your* pressure problems better—and at less cost! If you require precision cylindrical steel parts in high volume, give us your specifications, and quantity required. We'll be glad to show you how *Koldflo* can turn your new designs into new and better products.

Mullins Koldflo extrudes this 4¾" diameter accumulator shell in one piece. These extrusions can be furnished in a variety of shapes and sizes and with a choice of mechanical properties. Tolerances are extremely close as made. Surface finish measures 60 RMS or better, depending on shape.

"How would you tool-up to make an egg?" For copy of informative new booklet, write Koldflo Division, Dept. G-5 Mullins Manufacturing Corporation, Warren, Ohio.

*Trade-Mark Reg. U.S. Pat. Off.

DISTRICT SALES ENGINEERING OFFICES

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500 Fifth Avenue
Phone: Pennsylvania 6-2773

DETROIT
18268 James Couzens Highway
Phone: Diamond 1-1490

CHICAGO
332 South Michigan Avenue
Phone: Harrison 7-3725

Koldflo
DIVISION
MULLINS MANUFACTURING CORPORATION
Warren, Ohio

Phone: 2-1166

For more information on products advertised, use Inquiry Card, page 253

Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded

Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Mahon, R. H. Co., Detroit 34, Mich.
Verson Allsteel Press Co. 93rd St. & S. Kenwood Ave., Chicago, Ill.

FURNACES, Heat-Treating

General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

FURNITURE, Shop

Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

GAGES, Air

Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Comparator

Ames, B. C., Co., Waltham 54, Mass.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth

Ames, B. C., Co., (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St. New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton · Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Electric

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GAGES, Height

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol; Mass.

GAGES, Plug, Ring and Snap

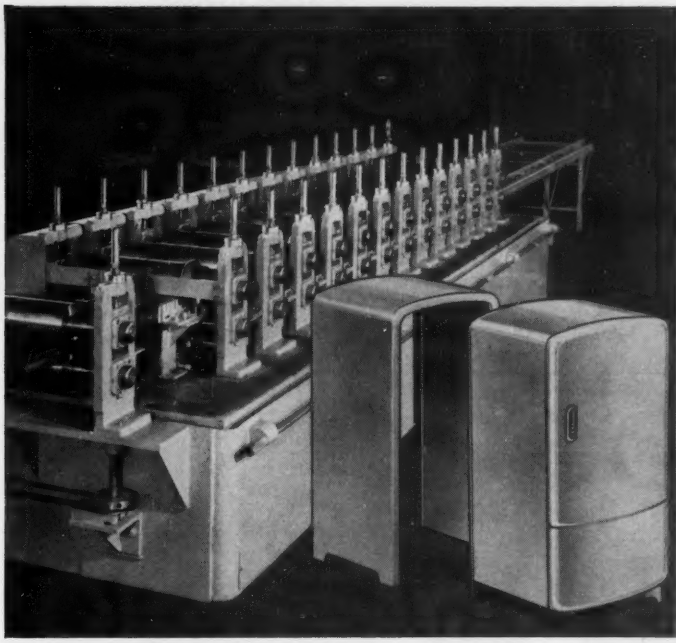
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Elgin National Watch Co., Aurora, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co. Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GAGES, Surface

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass.

(Continued on page 320)

For more information on products advertised, use Inquiry Card, page 253



Refrigerator shells now being made almost exclusively in Yoder Cold Roll Forming machines, from flat sheets forming sides and top.

In autos, buses and railroad coaches, cold roll formed mouldings and panels serve many purposes, both inside and out.

Cold Roll Formed components enter extensively into this Stransteel home and many other factory-built structures.

1001 things now being done by
COLD-ROLL-FORMING

Especially if your business has grown from modest beginnings to sizable volume, it is time to take a fresh look at the economic and other possibilities of cold roll forming.

The modern cry for streamlined design and automation is admirably met by Yoder Cold Roll Forming equipment. Things are being done today by this process which yesterday were not thought possible. Take refrigerator cabinets, for example: Nearly all of them are now formed in one passage through a Yoder machine from a flat sheet which is then transversely bent, as illustrated, to make the top and the sides.

Likewise in autos, buses and railroad coaches, roll-formed shapes are extensively used both inside and outside, for combination decorative and functional mouldings and panels.

Homes, storage and warehouses, industrial, retail and wholesale structures are most economically fabricated and erected largely from cold roll formed shapes.

The above are but a few of the many end uses for roll formed sections which are illustrated in the Yoder C.R.F. Book—with explanatory text on the machines, the art, end uses and economics of cold roll forming. A copy is yours for the asking.

THE YODER COMPANY
5504 Walworth Ave., Cleveland 2, Ohio

★ **COLD-ROLL-FORMING** and auxiliary machinery
★ **GANG SLITTING LINES** for Coils and Sheets
★ **PIPE and TUBE MILLS** — cold forming and welding

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

(*Continued on page* 322)

For more information on products advertised, use Inquiry Card, page 253

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers.

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Re., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Lees-Bradner Co., Cleveland, Ohio
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 13, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Westinghouse Electric Corp., E. Pittsburgh, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

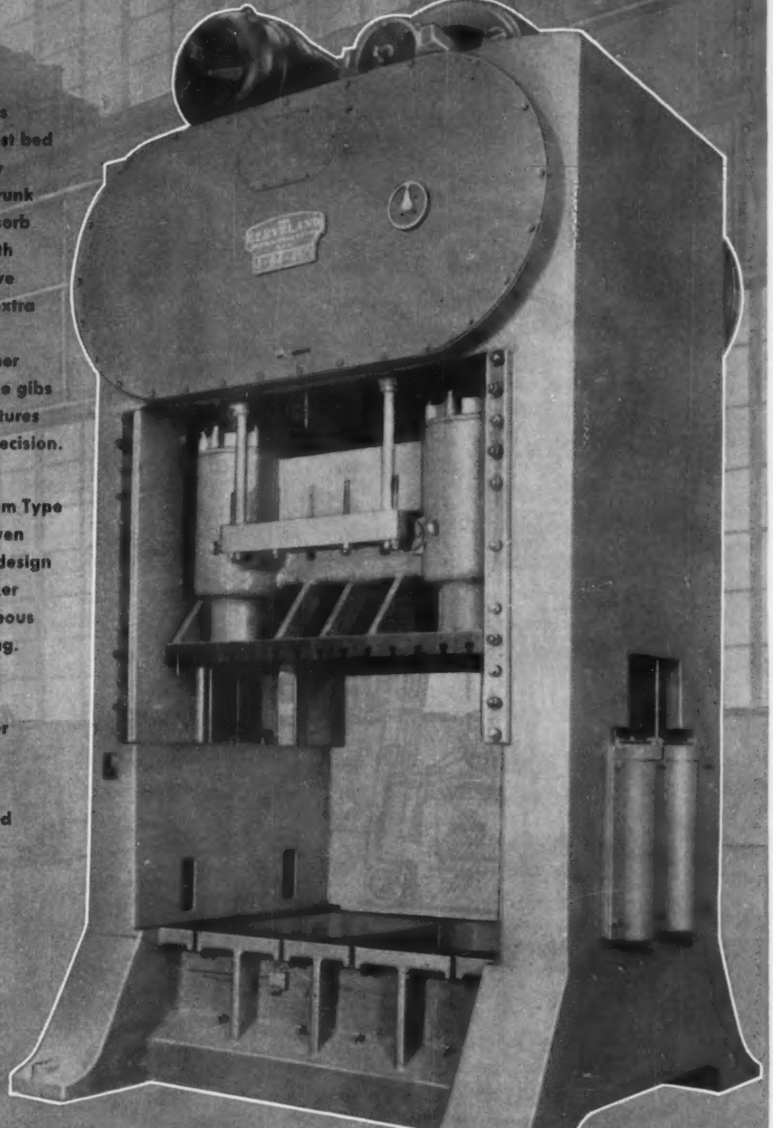
GEARS, Rawhide and Non-Metallic

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.

(*Continued on page* 324)

For more information on products advertised, use Inquiry Card, page 253

You get both High Production and Dependable Precision with new CLEVELAND Presses!



Every Cleveland Four-Point Press features an extremely rugged construction. The cast bed and uprights are secured to the crown by tie-rods that have been heated then shrunk into place. These rods, not the frame, absorb all stress. These presses are designed with an ample margin of safety over and above rated capacity. All slides are fitted with extra long bearing surfaces to insure accurate guidance during entire slide stroke whether the load is "on center" or "off center." The gibs are readily adjustable. These design features assure lasting accuracy for dependable precision.

Our trouble-free (patented) Cleveland Drum Type Friction Clutch and Brake have been proven ideal for high production operation. The design and lightness of parts contribute to quicker starting and stopping. You get instantaneous slide control at all times and perfect timing. Costly down-time due to clutch failure is virtually eliminated. Its light-weight construction and cool-running design offer important power savings.

Many companies have already discovered important operating economies gained with new Cleveland Presses. They'll produce profits for you, too! Just write or call. A Cleveland sales engineer will gladly help you select the right Cleveland for your requirements. He'll show you why a Cleveland is your best buy.

Cleveland Four-Point Press—Stroke of slide 18", adjustment of slide 12", shut-height 54", bed and slide area 60 x 84", capacity 450 tons.

THE CLEVELAND PUNCH & SHEAR WORKS CO.

Established 1880

1880 75 1955 YEARS OF CONSTANT PROGRESS

Diamond Anniversary

POWER PRESSES
FABRICATING TOOLS

E. 40TH & ST. CLAIR AVENUE · CLEVELAND 14, OHIO

CITY FOUNDRY DIVISION · SMALL TOOL DEPARTMENT

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

GRADUATING MACHINES

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Mches, Carbide Tool

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

GRINDERS, Portable Electric and Toolpost

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING FIXTURES

Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivette Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

GRINDING MACHINES, Broach

Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

(Continued on page 326)

For more information on products advertised, use Inquiry Card, page 253

Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Chucking

Baird Machines Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Landis Tool Co., Inc., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Drill

Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Union Twist Drill Co., Athol, Mass.

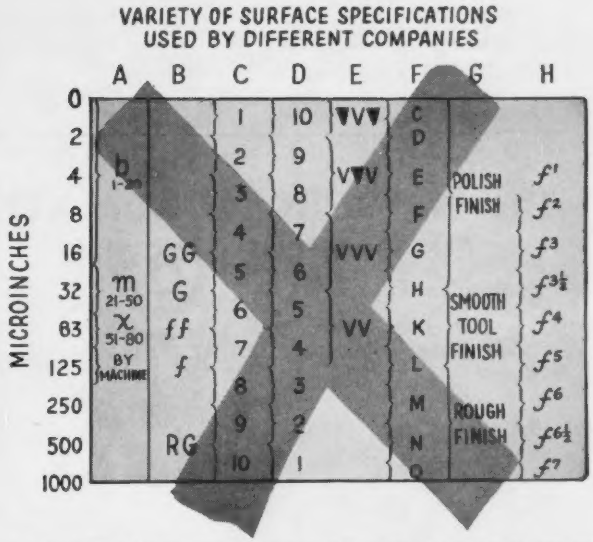
GRINDING MACHINES, Face

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

GRINDING. MACHINES, Flexible Shaft

See Flexible Shaft Equipment
(*Continued on page* 328)

Confusion eliminated!



NEW ASA STANDARD ESTABLISHES UNIFORM PRACTICE FOR SPECIFYING AND MEASURING SURFACE FINISH

One uniform standard for specifying and measuring surface finish of machined parts now replaces a multitude of individual practices. This eliminates conflicting ideas and arguments, saves time, ends guesswork.

With the new ASA and MIL-10 Standards your engineers can now specify surface roughness and character of a surface, in the same terms as other plants, your suppliers *and your customers.* When you use the new industry-wide standard you'll save time and money!

USE THE BRUSH SURFINDICATOR*

...THE ONLY INSTRUMENT COMPLETELY MEETING THE NEW STANDARD!

When you specify in accordance with the New Standard, you'll naturally want to make shop measurements in the same terms. The Brush Surfindicator is the only instrument which meets all the requirements and recommendations for surface finish (instrumentation). It's designed for shop use —highly accurate—easy to operate—portable and lightweight—and priced within the range of every shop! Send coupon for excerpts of the New Standard, and information on the SURFINDICATOR today!

*Trade-Mark

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3405 Perkins Avenue, Cleveland 14, Ohio

☐ Please send free booklet describing how new ASA Standard B46.1 benefits me.
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Company ______
Address ______
City ______ *State* ______

BRUSH ELECTRONICS COMPANY

INDUSTRIAL AND RESEARCH INSTRUMENTS
PIEZOELECTRIC MATERIALS • ACOUSTIC DEVICES
MAGNETIC RECORDING EQUIPMENT AND COMPONENTS

Division of Clevite Corporation

For more information on products advertised, use Inquiry Card, page 253

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobbs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Moore Special Tool Co. Inc., 724 Union Ave., Bridgeport, Conn
Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear Blade

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

GRINDING MACHINES, Piston Ring

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

For more information on products advertised, use Inquiry Card, page 253

AUTOMATION at its Best

... *uses*

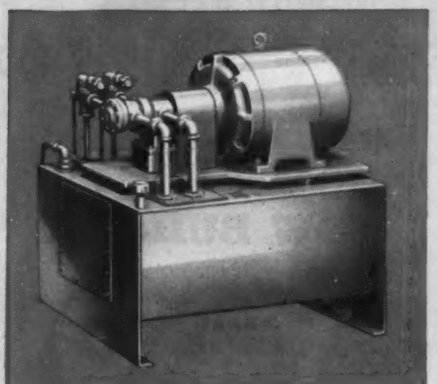
Cross Transfer-Matic performs 555 machining and 133 inspection operations on 100 V-8 cylinder blocks per hour with one operator. Shown here are three of five sections that operate automatically . . . individually or in any combination.

VICKERS® Hydraulics

This mammoth Cross Transfer-Matic uses Vickers Hydraulics exclusively to move cylinder blocks through 688 machining operations and inspections . . . for tool traverse and feed . . . to turn the blocks as needed . . . to clamp and unclamp, etc.

In addition to the advantages inherent in hydraulic control, Vickers Hydraulics gives you the benefits of a nation-wide and full-time field engineering and service organization to assure correct application and operation with least maintenance. Highly efficient Vickers Pumps reduce power costs.

The Vickers Application Engineer near you will be glad to show you the benefits you can obtain by using Vickers Hydraulics. Write for a copy of Bulletin 5002-A.



One of 60 Vickers Hydraulic Power Units used on this Cross Transfer-Matic. Some are standard units while others are custom-built by Vickers. Each is a complete "package" for an individual hydraulic circuit; it includes the necessary pumps, valves, oil reservoir, electric motor and controls, as well as all hydraulic accessories (oil filter, air cleaner, oil level gauge, etc.). The result is design simplification and savings in installation and maintenance costs.

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DIVISION OF THE SPERRY CORPORATION

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7054

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

For more information on products advertised, use Inquiry Card, page 253

GRINDING MACHINES, Radial

Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co. 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hirschmann Co., Carl, 30 Park Ave., Mannasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I. York 17, N. Y.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New

GRINDING MACHINES, Worm

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.

GROOVING TOOLS, Internal

Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

HAMMERS, Forging Air

Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.

(*Continued on page 334*)

STANDARD
technical service clicks at Argus Camera

Personnel at Argus Camera Company were having trouble with the grinding of thread plug gauges. Grinding oils used failed to hold the required accuracy. They called in L. H. Walker, Standard Oil industrial lubrication specialist. He recommended Standard's SUPERLA Thread Grinding Oil A, and Argus began using it. That was four years ago. What happened? SUPERLA Thread Grinding Oil has helped Argus grind thread plug gauges with such accuracy, so consistently, rejects are virtually eliminated.

Small job? Yes. Small volume of oil used? Yes. But the results are big business to Argus Camera. That makes it important to Standard Oil. It is another demonstration of what this unbeatable combination can do when put to work:

1. **Standard lubrication specialists capable of giving technical help.**
2. **Top quality products *that deliver results required.***

Put this combination to work in your plant. In the Midwest there is a lubrication specialist in your nearby Standard Oil office ready to help you. Call him. Or contact Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

STANDARD OIL COMPANY
(Indiana)

Omer L. Parks (left), tool and gauge grinder for Argus Camera, inspects thread plug gauge with L. H. Walker, Standard Oil industrial engineer. Lyman Walker has been working with customers for 25 years helping them solve problems like the one at Argus. A native of Detroit, Lyman Walker is familiar with the lubrication problems of industry in the territory he serves. This together with his wide experience makes him ideally qualified for this work. Customers find his experience pays off *for them.*

HAMMERS, Pneumatic

Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

HAMMERS, Portable Electric

Millers Falls Co., Greenfield, Mass.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.

HAMMERS, Shaft

Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft

Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HARDENING EQUIPMENT

Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

HARDNESS TESTING INSTRUMENTS

Olsen, Tinius, Testing Mch. Co., Willow Grove, Pa.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave., and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEADING MACHINES

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

HEAT TREATING EQUIPMENT

Nor-Cote, Inc., 11425 Timken Ave., Van Dyke, Mich.

HOBBING MACHINES

See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS

Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HOISTING AND CONVEYING EQUIPMENT

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.

HOISTS, Chain, Etc.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric

Philadelphia Gear Works Inc., Erie Ave. and G St., Philadelphia, Pa.

HONING MACHINES, External

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HONING MACHINES, Internal (Cylinder)

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

(Continued on page 338)

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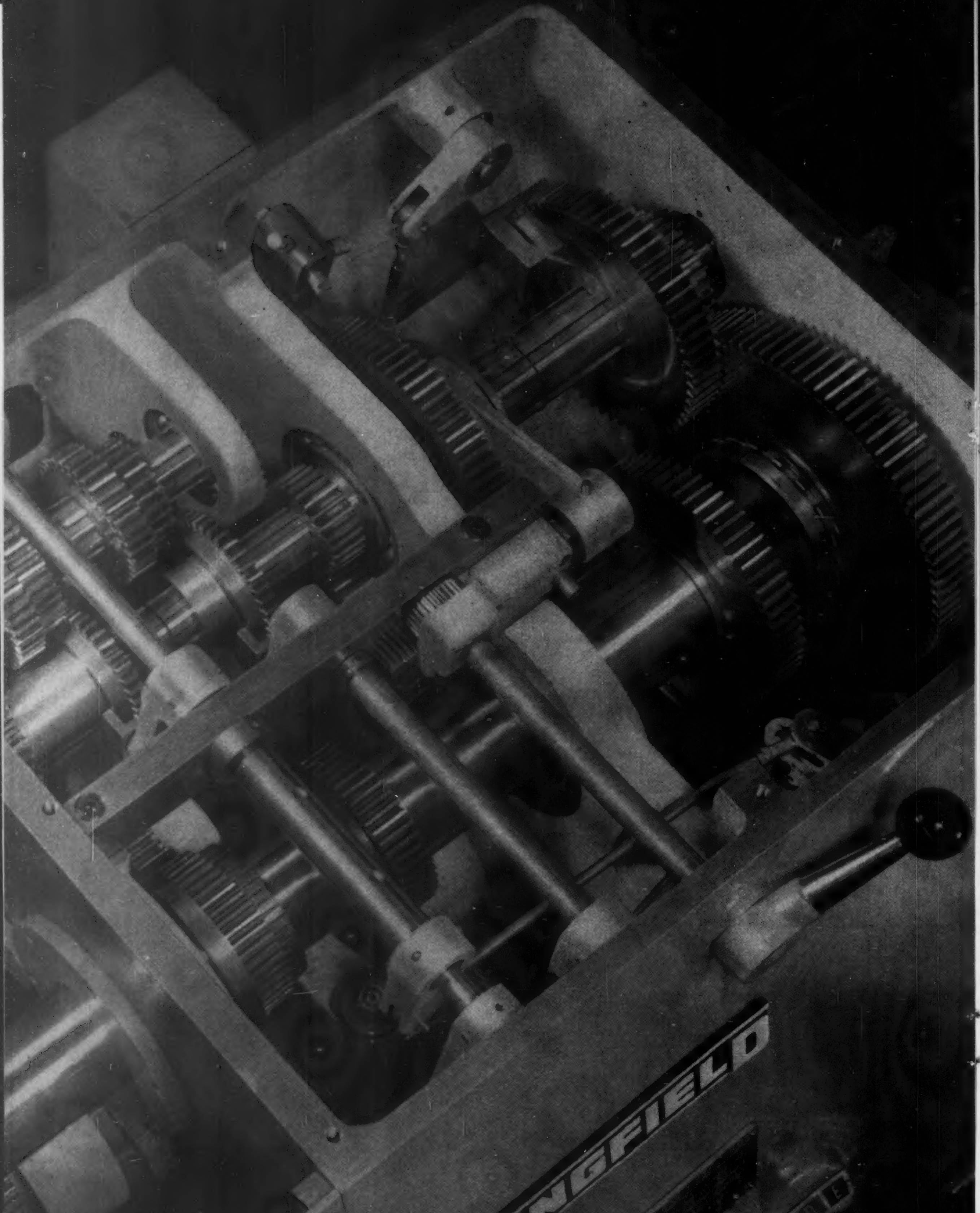
SPRINGFIELD

HONING STONES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HONING TOOLS AND FIXTURES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HOSE, Leather, Rubber, Metallic, Etc.

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

HYDRAULIC MACHINERY

Tools and equipment

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.
Barnes, John S., Corp., Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

INDEXING AND SPACING EQUIPMENT

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

INDICATORS, Dial

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Micrometrical Mfg. Co. (Surface roughness & waviness), 321 S. Main St. Ann Arbor, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

(Continued on page 342)

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Now...load rate your bearings at higher values

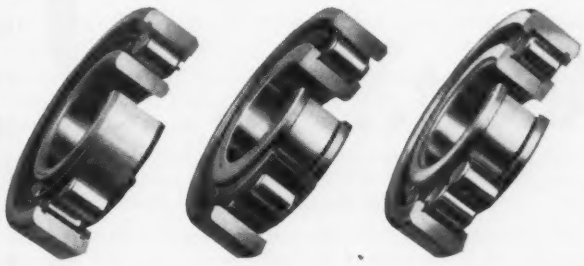
with Tru-Rol CROWNED ROLLERS

Greater capacity . . . longer life . . . or a precisely balanced gain of *both* factors. That is the choice offered you by the "crowned" rollers of Tru-Rol bearings.

By finish grinding a carefully selected crown radius on roller ends, Rollway relieves high stress areas, insures uniform distribution of load over the entire length of the roller. Rollers can take heavier loads without excessive end-fatigue, and are less subject to the effect of slight misalignment or deflection.

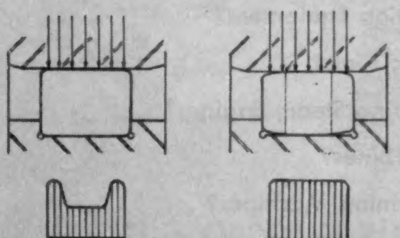
The result is load rating at higher values for greater capacity, longer service life . . . or both. If this choice interests you, why not write for the complete story. Rollway Bearing Co., Inc., Syracuse, N. Y.

Tru-Rol Bearings with crowned rollers are available in 3 types



Stamped Steel Retainer with Guide Lips — Segmented Steel Retainer — Full Roller

Comparative Stress Patterns under Uniform Loads for Straight and Crowned Cylindrical Rollers



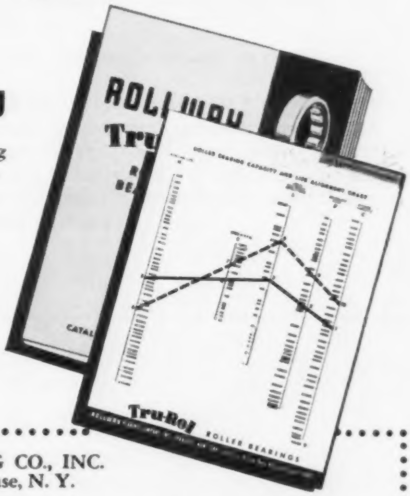
Stress pattern for a straight cylindrical roller under load. Note uneven end-loading.

Stress pattern for crowned roller under load. Crowning radius is exaggerated for clarity.

FREE New Catalog

features RBEC* bearing selection formula converted to simple nomograms! Send for a copy today.

*Roller Bearing Engineers' Comm. — Anti-Friction Bearing Mfrs. Assn.



ROLLWAY BEARINGS

COMPLETE LINE OF RADIAL AND THRUST CYLINDRICAL ROLLER BEARINGS

ROLLWAY BEARING CO., INC.
551 Seymour St., Syracuse, N. Y.

Please send free copy of your new Tru-Rol Catalog with extra Alignment Charts.

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Firm Name__________

Address__________

City__________ Zone____ State__________

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INDUSTRIAL

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- Principles of Lubrication?
- Running in New Bearings?
- Types of Lubricants and their Use?
- Physical and Chemical Characteristics of Lubricants?
- Methods of Lubricant Supply?
- Plain Bearings?
- Anti-friction Bearings?
- Organization of a Lubrication Department?
- Storage and Handling of Lubricants?
- The Purification and Reclamation of Oil?
- Hydraulic Systems and Equipment?
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- Four-Stroke Gasoline Engines?
- Diesel Engines?
- Compressors?
- Refrigeration Equipment?
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- Reciprocating Steam Engines?
- Steam Turbines?
- Metal Forming Machines?
- Metal-Cutting Machines?
- Cutting Fluids?
- Gears for Power Transmission?
- Chains, Ropes, Belts and Couplings?
- Storage Preservation of Machinery?

INDUCTION HEATING EQUIPMENT
General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

INTENSIFIERS, Hydraulic
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.

JACKS, Machine Leveling
Enterprise Mch. Parts Corp., Detroit, Mich.

JACKS, Planer
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

JIG BORER
See Boring Machines, Jig

JIGS AND FIXTURES
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Heuser Mfg. Co., 1638 N. Paulina St., Chicago, Ill.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

JOINTS
See Fittings, Hydraulic, Pneumatic, Etc.

KEYS, Woodruff, Machine, Special
Standard Automotive Parts Co., 660-668 Nims St., Muskegon, Mich.

KEYSEATERS
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

KNURL HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.

KNURLING TOOLS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES
Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LAPPING PLATES, Hand
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

LATHE AND GRINDING DOGS
Armstrong Bros. Tool Co. 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHE ATTACHMENTS
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
Knapp, B. L., Ind., 107 N. Franklin Ave., Syracuse 4, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.

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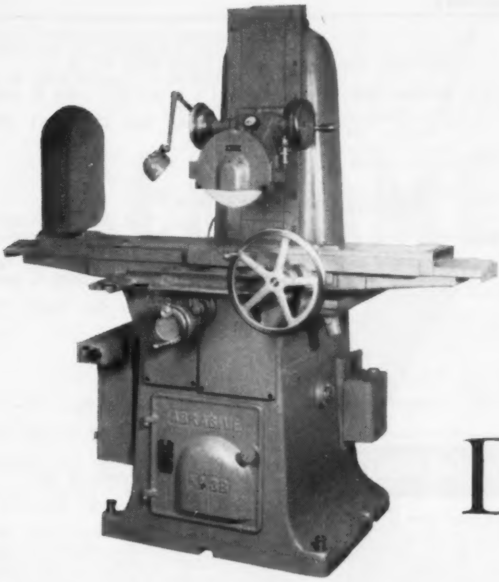


Do you know about this low priced accurate 8"x 24" hand feed surface grinder built by Abrasive?

May we give you the facts . . .

ABRASIVE
ACCURACY BOOSTS PRODUCTION

ABRASIVE MACHINE TOOL CO.
12 Dunellen Road East Providence 14, R. I.

Please send catalog describing Abrasive 3B and M3 Surface Grinders.

Name..

Company..

Address..

....

....

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Automatic

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Axle

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Duplicating

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hydro-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Engine and Toolroom

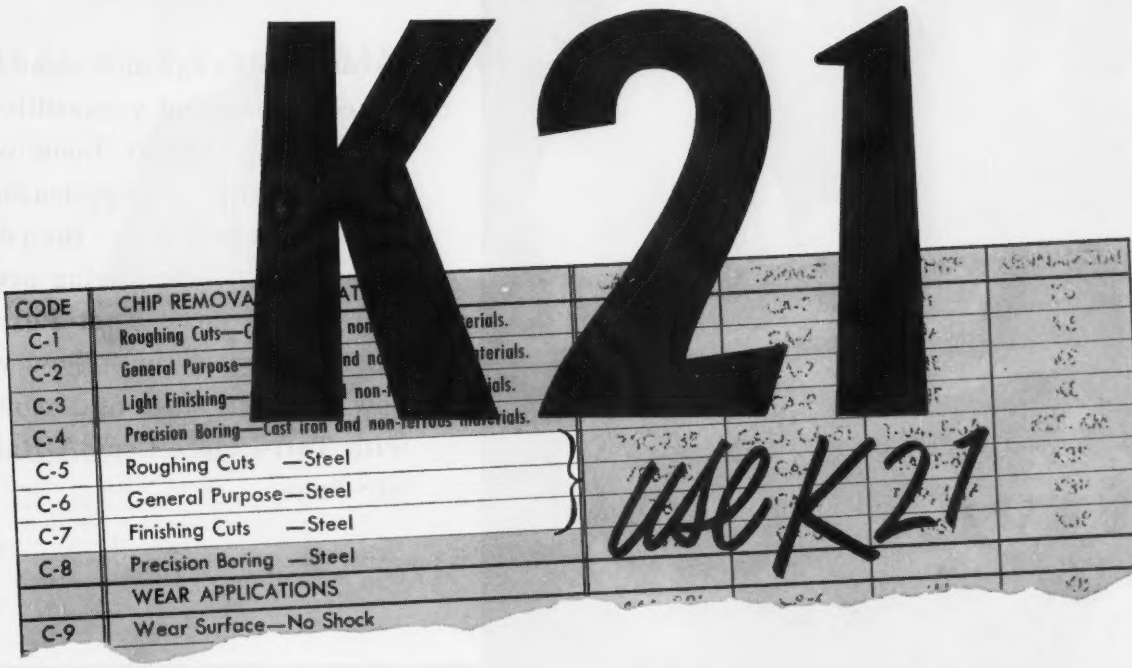
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.

(*Continued on page* 348)

For more information on products advertised, use Inquiry Card, page 253

Announcing

KENNAMETAL* GRADE



the new, superior General Purpose steel-cutting carbide

K21 . . . the new Kennametal General Purpose steel-cutting grade . . . is out-performing all other carbides in its field, even K2S, the leader of all General Purpose grades in the carbide industry for over a decade. Its superior performance is due to high edge strength, combined with superior wear qualities and resistance to cratering. K21 was created to help get highest productivity from today's high-speed machines, yet, due to its range, it does an excellent job on older, slower-speed machines.

Naturally, K21 has been thoroughly tested. It has demonstrated great versatility on planing, turning, boring, plunging, and interrupted cutting . . . on such materials as forgings, sandy castings, centrifugal castings, plate, bar stock, and weldments.

K21 simplifies the problem of grade selection since it performs in all three groups—general steel-cutting, heavy roughing, and finishing. It is ideal for machining the newer high tensile strength steels, has high resistance to thermal shock, and is less susceptible to grinding cracks.

Why not try Kennametal Grade K21 *now!* It is available from stock in the most popular blanks, tools and inserts. Order today. KENNAMETAL INC., Latrobe, Pennsylvania.

K21 OFFERS

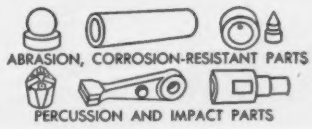
- Superior Wear Qualities
- Exceptionally High Edge Strength
- High Resistance to Thermal Shock

K21 is designed for cutting stainless steels, nickel steels, heat-resistant alloys, and high tensile alloy steels.

*Registered Trademark

5580

INDUSTRY AND **KENNAMETAL** *...Partners in Progress*



Solve Your Inspection
Taft-Peirce

No other air gage offers you the speed, range and versatility of a T-P CompAIRator. Look over these features and applications and see for yourself — then discuss your specific gaging problems with your Taft-Peirce sales engineer. He'll show you how to save time and money with Taft-Peirce CompAIRator Air Gages.

T-P COMPAIRATORS GIVE YOU THESE 5 ADVANTAGES

1. Instant Reading. No flutter . . . no creep . . . no appreciable time lag. Readings are virtually instantaneous even when extension hoses thirty feet long separate gaging member from CompAIRator.

2. More Versatile. No other air gage matches the accuracy over such a wide variety of applications . . . from simple diameters to simultaneous checks of such relationships as concentricity, squareness, and center distance.

3. Velocity-type Circuit. Venturi principle offers 3 advantages — accurate gaging of ID's as small as .055″ . . . magnification change simply by substituting one part and dial face . . . and linear readings.

4. Wider Tolerance Range. One basic CompAIRator with suitable gaging members and venturis, can check any specific tolerance range from .0001″ to .125″.

5. Gages Rough Surfaces. Contact type members allow precision gaging of parts with surface finishes beyond 50 micro-inches, rms . . . retain the self-positioning advantages of direct air gaging.

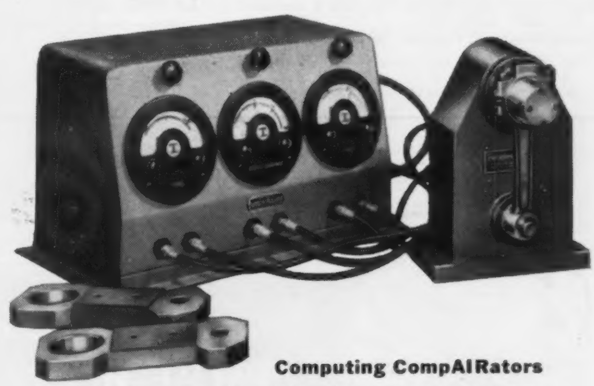
THE TAFT-PEIRCE

Problems by Air with CompAIRator Air Gages...

THERE'S A T-P COMPAIRATOR FOR EVERY INSPECTION NEED

CompAIRators

Available in single, double, or multi-dial units. Can be used with standard air plugs (for through-holes, counter-bores, or blind holes), air rings, and air snap gages — directly attached to cabinet, or to extension hose. Contact type members permit air gaging of rough surfaces. Special fixtures designed and built to order.

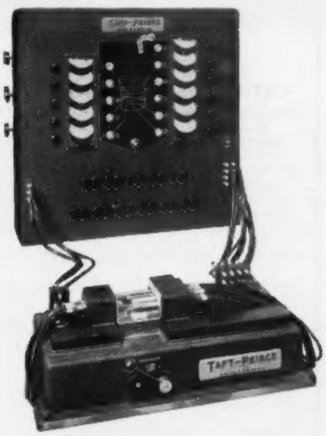


Computing CompAIRators

For measuring such relationships as squareness or center distance, a Computing CompAIRator eliminates making two separate measurements and a calculation. Does the whole job — measures, computes, and indicates the result instantly on a single dial. 3 dial unit above replaces 6 ordinary indicators.

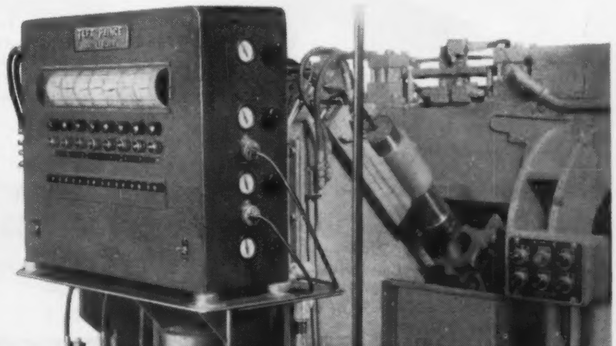
Air-Electric CompAIRators

For rapid inspection of a number of dimensions. Lights indicate any dimension out of tolerance. Exact reading can be then taken from proper dial face. Compact angular mounting of dials, either horizontally or vertically, speeds and simplifies reading.



Automatic CompAIRators

Easily incorporated into production lines where maximum speed of inspection is required. Automatically checks parts, rejects off-size work. Can be built directly into high production machine tools to actuate size control mechanism.



MANUFACTURING CO.
WOONSOCKET, RHODE ISLAND

T P

T-P means Top Precision

Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.

Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.

Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

Pratt & Whitney, West Hartford 1, Conn.

Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

Seneca Falls Mch. Co., Seneca Falls, N. Y.

Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

Sidney Machine Tool Co., Sidney, Ohio.

South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gap

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Gun

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Machine Tool Co., Springfield, Ohio.

LATHES, Hollow Spindle

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type

Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

See Lathes, Engine and Toolroom

LATHES, Turret

Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Potter & Johnson Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

LAYOUT FLUID

Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS

Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

(Continued on page 350)

For more information on products advertised, use Inquiry Card, page 253

For more information on products advertised, use Inquiry Card, page 253

LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Socony Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MAGNETIC BASES FOR INDICATORS

du Mont Corp., Greenfield, Mass.

MANDRELS

See Arbors and Mandrels.

MARKING MACHINES AND DEVICES

Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.

MEASURING MACHINES AND INSTRUMENTS, Precision

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Max Wyler, 611 W. 43rd St., New York 36, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR

Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

METAL, Bearings

See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.,

METAL FINISHINGS

Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

METERS

See Recording Instruments

MICROMETERS

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co. Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MICROSCOPES, Toolmakers

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS

Brown & Sharpe Mfg., Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Milholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Hardinge Bros., Inc., (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co. 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Profile

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

(Continued on page 352)

Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type

Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Toll Corp., Rochester N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch., Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Burke Machine Tool Div., Cincinnati 27, Ohio.

MODEL AND EXPERIMENTAL WORK

See Special Machinery and Tools

MOLD AND DIE COPYING MACHINES

Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

MOLDING MACHINES, Plastic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

MOLYBDENUM

Climax Molybdenum Co., New York, N. Y.

MOTORS, Electric

Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

MOTORS, Hydraulic

Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NIBBLING MACHINES

International Nickel Co., Inc., 67 Wall St., New York, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

NIPPLE THREADING MACHINERY

Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap

Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Union Drawn Steel Co., Div., Republic Steel Corp., Massillon, Ohio.

NUTS, Self-locking

Grip Nut Co., 310 S. Michigan Ave., Chicago 4, Ill.

NUTS, Thumb or Wing and Cap

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only).
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

(Continued on page 354)

For more information on products advertised, use Inquiry Card, page 253

For more information on products advertised, use Inquiry Card, page 253

OIL EXTRACTORS AND CLEANERS
De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS
Fischer Machine Co., 310 No. 11th St., Philadelphia, Pa.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

OIL SEALS
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS
Madison-Kipp Corp., Madison, Wis.

OILS, Cutting
See Cutting and Grinding Fluids.

OILS, Lubricating
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Socony Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.

OILS, Soluble
See Compounds, Cutting, Grinding, Metal Drawing, Etc.

OPTICAL FLATS
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

ORDNANCE MACHINES, Speliol
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.

PAINTING EQUIPMENT, Spray
Lowe Bros. Co., Dayton, Ohio.
Ransburg Electro-Coating Corp., 1234 Barth, Indianapolis, Ind.

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

PIPE, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

PLANER ATTACHMENTS
Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn R. R., Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PLANERS
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PLANERS, Double Housing and Openside
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A. Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Racktora, Ill.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PLATE ROLLS
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Angle
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.

PLATES, Surface
Brown & Sharpe Mfg. Co., Providence, R. I.
Brush Electronics Co., 3405 Perkins Ave., Cleveland, Ohio.
Challenge Machinery Co., Grand Haven, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St. Ampere, N. J.

PNEUMATIC EQUIPMENT
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Onsrud Machine Works Inc., 3940 Palmer St., Chicago, Ill.

POLISHING LATHES AND MACHINES
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Millers Falls Co., Greenfield, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable
Sundstrand Machine Tool Co., 2531 11th St. Rockford, Ill.

POWER UNITS, Hydraulic
See Hydraulic Power Units or Tools Heads

PRESSES, Arbor
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
duMont Corp., Greenfield, Mass.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.

For more information on products advertised, use Inquiry Card, page 253

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PRESSES, Foot

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St., Chicago, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
National Mchry. Co., Greenfield and Stanton Sts. Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co. (Hydroform) Cincinnati 9, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St., Chicago, Ill.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Mch. & Welder Co., Warren, Ohio
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426, Clinton, Mo. (Bench)
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co. (Hydroform) Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St., Chicago, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.

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Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., 300 Lincoln Ave Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.

PRESSES, Straightening

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Niagara Machine & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

PROFILE—TRACING ATTACHMENTS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa. (Lathe).

PROFILING MACHINES

Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George Machine Co., 1110 W. 13th St., Racine, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I.

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Pioneer Pump Div., Detroit Harvester Co., 14300 Tireman Ave., Detroit 28, Mich.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tompkins-Johnson Co., Jackson, Mich.
Vickers Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Pioneer Pump Div., Detroit Harvester Co., 14300 Tireman Ave., Detroit 28, Mich.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg. N. J.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Pump Div., Detroit Harvester Co., 14300 Tireman Ave., Detroit 28, Mich.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY

Allen, Alva F., Box 426, Clinton, Mo.
Buffalo Forge Co., 490 Broadway, Buffalo. N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Engineering & Research Corp., Riverdale, Md.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Wiedermann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.

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Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Mohawk Tools, Inc., 910 E. Main St., Montpelier, Ohio.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Taper Pin

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twists Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Kaufman Manufacturing Co., Manitowoc, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

RECORDING INSTRUMENTS

National Acme Co. (for counting) 170 E. 131st St., Cleveland, Ohio
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

REELS, Stock, Standard and Automatic

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnace

Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature

General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.

Oakite Products, Inc., 19 Rector St., New York, N. Y.

RETAINING RINGS FOR BEARINGS, Etc.

Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RHEOSTATS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

RIVET SETS

Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

RIVETERS, Hydraulic

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.

RIVETERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E 44th St., New York, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St. Chicago 18, Ill.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

RIVETING MACHINES

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.

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RIVET MAKING MACHINES
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

RUBBER PRODUCTS
Garlock Packing Co., Palmyra, N. Y.

RULES, Steel
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

RUST PREVENTIVES
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT
See Blast Cleaning Equipment

SANDERS
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

SAW BLADES, Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Barnes, W. O. Co., Inc., Detroit, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.

SAW SHARPENING MACHINES
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

SAWING MACHINES, Friction
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWING MACHINES, Metal Cutting Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grob, Inc., Grafton, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWS, Circular Metal Cutting
Barnes, W. O. Co., Inc., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SAWS, Metal Cutting Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

SAWS, Portable Electric
Millers Falls Co., Greenfield, Mass.

SAWS, Screw Slotting
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

SCREW DRIVING AND NUT SETTING EQUIPMENT
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

 For more information on products advertised, use Inquiry Card, page 253

SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P.O. Box 350,
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK

Eastern Mch. Screw Corp., New Haven, Conn.
Mueller Brass Co., Port Huron 35, Mich.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, M. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown. Pa.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wisc.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand

See also Lathes, Turret

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co. Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Chicago Screw Co., Bellwood, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New Cork, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-tapping, Drive

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

SCREWS, Thumb

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SEALS AND RETAINERS, Oil or Grease

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

SECOND-HAND MACHINERY, Etc.

Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co. Box 770, Saginaw, Mich.

SEPARATORS, Centrifugal

De Laval Separator Co., Poughkeepsie, N. Y.

SEPARATORS, Oil or Coolant

Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

SHAFTING, Steel

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SHAFTS

National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

SHAFTS, Hollow-Bored

Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

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SHAPER-PLANERS
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

SHAPERS
American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Smith & Mills Shapers, Inc., Div. Hamilton-Thomas Corp., Hamilton, O.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPES, Structural
Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

SHEARS, Rotary
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

SHEET METALS
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
New Jersey Zinc Co., 160 Front St., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St. Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEET METAL MACHINES, Shrinking, Stretching, Forming & Flanging.
Engineering & Research Corp., Riverdale, Md.

SHEETS, Iron and Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHIMS
Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SOCKETS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Wks. 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SPECIAL MACHINERY AND TOOLS
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.

For more information on products advertised, use Inquiry Card, page 253

Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. C.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., Detroit, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Fischer Machine Co., 310 No. 11th St., Philadelphia, Pa.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
La Salle Tool Co., Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Mercury Engrg. Corp., Milwaukee, Wis.
Michigan Tool Co., 7171 E. McNicholas Rd., Detroit 12, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Boston Gear Work, 320 Main St., North Quincy 71, Mass.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

SPINDLES, Boring and Milling

Pope Mchry. Corp., Haverhill, Mass.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverhill, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn.
Mullins Mfg. Corp., Salem, Ohio.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 Ave., Pittsburgh, Pa.
Wheeler-Lovejoy & Co., Inc., Cambridge, Mass.

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STEEL, Cold Drawn

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS

See Alloys, Steel

STEEL BARS

See Bars, Steel

STEEL STOCK GROUND FLAT

Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

STELLITE

Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCK STOPS

Wohlnip Products, Inc., 634 Central Ave., East Orange, N. J.

STOCKS, Die

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.

STONES, Oil or Sharpening

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS

Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES

Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

STRAIGHTENERS, Flat Stock and Wire

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

STUD SETTERS

Errington Mechanical Laboratory Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

SUB-PRESSES

Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE CHECKING EQUIPMENT

Micrometrical Mfg. Co., 321 S. Main St., Ann Arbor, Mich.

For more information on products advertised, use Inquiry Card, page 253

SURFACE PLATES
See Plates, Surface

SWAGING MACHINES
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.

SWITCHES
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

TACHOMETERS
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

TANGS, Replaceable, Drill & Reamer
Nu-Tangs Inc., 1335 Bates St., Cincinnati, Ohio.

TAPER PINS, Standard
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Chicago Screw Co., Bellwood, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Tapmatic Corp., 845 W. 16th St., Costa Mesa, Cal.

TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 70, Ohio.
Barnes Drill Co., 814 Chestnut Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Challenge Mchry. Co., Grand Haven, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield, Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O-Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Threadwell Tap & Die Co., Greenfield, Mass.

TAPS, Collapsing
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

TESTING EQUIPMENT, Tension, Compression, Fatigue, etc.
Olsen, Tinius, Testing Mch. Co., Willow Grove, Pa.

THREAD CUTTING MACHINERY
Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Lees-Bradner Co., Cleveland, Ohio
Pratt & Whitney, West Hartford 1, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Pierce Mfg., Co., Woonsocket, R. I.

THREAD CUTTING TOOLS
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield. Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.

(Continued on page 364)

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

THREAD GAGES
See Gages, Thread.

THREAD GRINDING MACHINES
See Grinding Machines, Thread

THREAD MILLING MACHINES
Coulter, James, Machine Co., Bridgeport 5, Conn.
Lees-Bradner Co., Cleveland, Ohio
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Waltham Machine Works, Newton St., Waltham, Mass.

THREAD ROLLING HEADS
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

THREAD ROLLING MACHINES
Landis Machine Co., Waynesboro, Pa.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.

TIN AND TERNEPLATES
Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besley-Welles Corp. 20 N. Wacker Drive, Chicago 6, Ill.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL BITS, Special Alloy
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL GRINDERS
See Grinding Machines for Sharpening, Turning and Planning Tools.

TOOL GRINDING ATTACHMENTS
Detroit Reamer & Tool Co., 2830 E. 7 Mile Rd., Detroit, Mich.

TOOL HOLDERS
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOLMAKERS' INSTRUMENTS
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL RESINS
Marblette Corp., 37-33 Thirtieth St., Long Island City 1, N. Y.

TOOL STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Valenite Metals Corp., Box 205, Royal Oak, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.

For more information on products advertised, use Inquiry Card, page 253

Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TRANSFER MACHINES, Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TRANSFORMERS

General Electric Co., Schenectady, N. Y.

TRANSMISSION, Variable Speed

Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Sillman St., Bridgeport 5, Conn.

TUBE FORMING AND WELDING MACHINES

Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Yoder Co., 550 Walworth Ave., Cleveland, Ohio

TUBE MILLS

Abbey-Etna Co., 2444 Maplewood Ave., Toledo 10, Ohio.
American Electric Fusion Corp., 2622 Diversey Ave., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
National Tube Div. U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.

TWIST DRILLS

See Drills, Twist

UNIVERSAL JOINTS

Baush Machine Tool Co., 156 Wassen Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.

VALVE CONTROLS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.

VALVES, Air

Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Lehigh Foundries, Inc., 1500 Leigh Dr., Easton, Pa.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

VALVES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1400 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.

VIBRATION INSULATION

American Felt Co., Glenville, Conn.

VISES, Machine

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engineering Co., Frankenmuth 2, Mich.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

VISES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

VISES, Planer and Shaper

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elan and Garrard Aves., Cincinnati, Ohio.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

VOLTMETERS

General Electric Co., Schenectady, N. Y.

WASHERS, Lock
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E. Massillon, Ohio.

WASHERS, Spring
Allmetal Screw Products Co., Inc., 821 Steawrt Ave., Garden City, N. Y. (Stainless Steel only.)
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E. Massillon, Ohio.

WELDING AND CUTTING EQUIPMENT Oxyacetylene
Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING AND CUTTING GAGES
Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING EQUIPMENT, Electric Arc
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
Federal Mch. & Welder Co., Warren, Ohio
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

WELDING EQUIPMENT, Electric, Spot, Butt, Seam, Etc.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
Federal Machine & Welder Co., Warren, Ohio.

WELDING POSITIONER
duMont Corp., Greenfield, Mass.

WELDMENTS
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Mahon, R. C., Co., Detroit 34, Mich.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

WIRE
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (American Steel & Wire Co. Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINERY
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

WIRE NAIL MACHINERY
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

WOODWORKING MACHINERY
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

WORM DRIVES
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

WRENCHES
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Ingersoll-Rand Co. (Impact, Pneumatic, Electric), Phillipsburg, N. J.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Detachable Socket
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Pipe
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

WRENCHES, Ratchet
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Tap
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.

WRENCHES, Torque Measuring
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

ZINC
New Jersey Zinc Co., 160 Front St., New York, N. Y.

For more information on products advertised, use Inquiry Card, page 253

 For more information on products advertised, use Inquiry Card, page 253

The Meehanite spur gears illustrated above have just passed their final inspection before shipment and receive the blessings of Inspectors H. Maybury, left; and J. F. Stahl.

These gears, boasting a total rough weight of 14360 lbs. are H-arm type, scheduled for use in rubber-working machinery. Strict adherence to specification, painstaking inspection from first to last—give these—and all gears produced by Stahl, the long, trouble-free service that means greater profit to you.

Pass to the head of the gear parade —get Stahl's estimate next time!

SPURS TO 72" PD, 1 DP
BEVELS TO 54" PD, 1 DP
SPIRAL, HELICAL and WORM GEARS TO 48" PD, 2 DP
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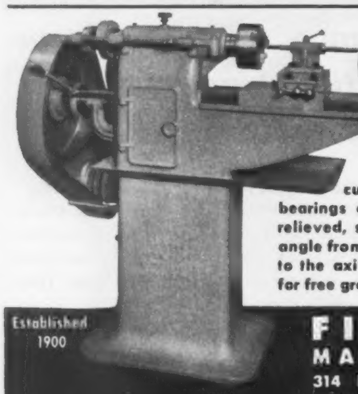

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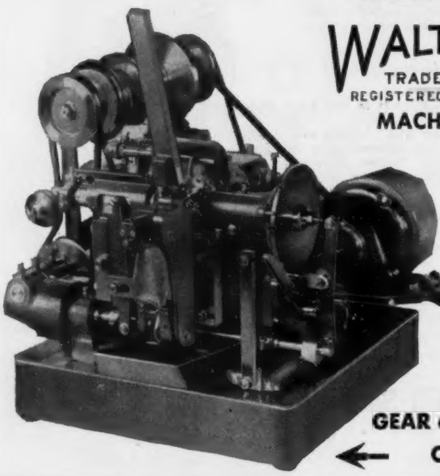

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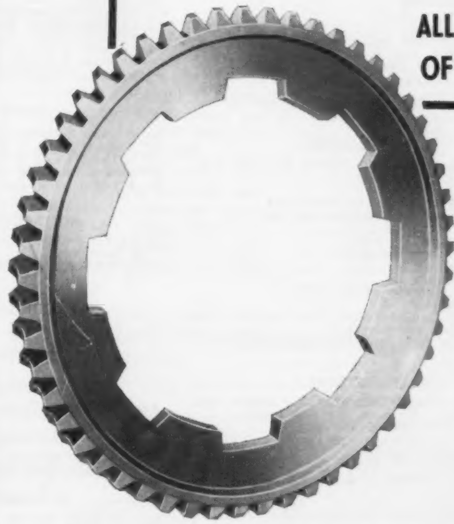

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